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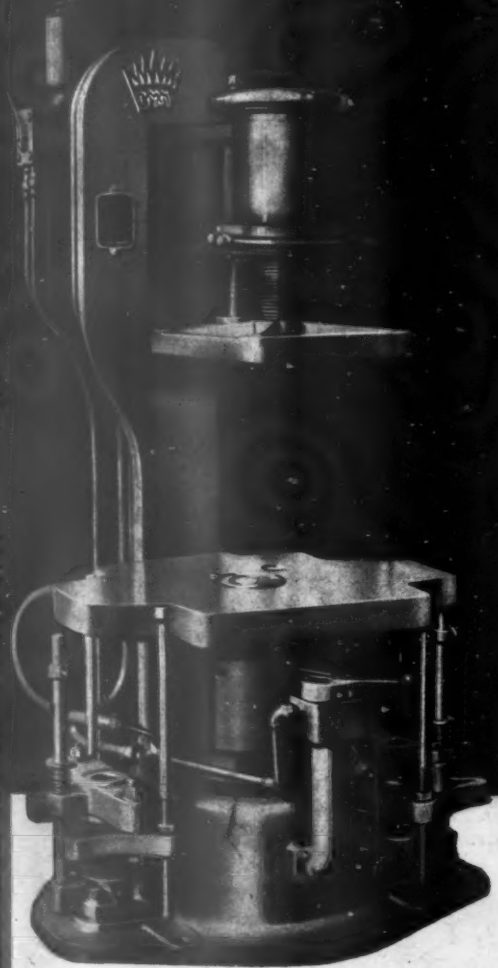

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Established 1903
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Going to a Meeting?

We have just been reading a book on meetings* by Sir Walter Puckey, and whilst it is somewhat scrappy, we can unreservedly recommend it to all who participate in gatherings, ranging between small sub-committee meetings to a participation in international congresses. The book has been dubbed "scrappy," because there are so many different types of meeting, and there is but little in common between some of them. However, during the reading of the book, it is easy to realize the particular type of meeting the author has in mind at any particular stage, but he makes no attempt to sort them out. In one case he is thinking of a meeting of a technical institute in the provinces, where both he and the lecturer received scant courtesy. This called to mind that many years ago, we printed a leading article on this subject, which was called "Pity the Poor Lecturer." This produced excellent results in foundry circles, and no doubt Sir Walter's strictures will be fertile in other fields.

Obviously, the author has attended many types of meeting and he has created precepts for getting the best out of the different types. They are to secure: (1) Joint communication (downwards or upwards); (2) joint co-operation (among all present); (3) joint responsibility for decisions, and (4) individual responsibility for carrying out the decisions. Wise chairmen will follow these precepts. In one chapter, the author expressed a dislike to taking a vote and here he has probably a small meeting in mind, where the chairman can sense the feeling of the meeting. Yet, we feel that as these meetings are supposed to be businesslike, the traditional method of taking a vote is not necessarily time-wasting.

The greatest value of the book lies in its worth to secretaries, though the author will not quite exonerate the chairman from his responsibilities. His survey in respect of advice to secretaries is remarkably complete and goes as far as a dissertation on chairs, which—as he rightly points out—can mar the prospects of a successful meeting. Some of the comments on speakers are remarkably apt, as for instance, the provision of some artifice to hide the wad of speaker's notes, for some in the audience have a habit of timing how long each sheet takes to deliver and estimating the length of the discourse—a system not calculated to stimulate one's interest. If the author agrees with us that his book is a bit "scrappy" owing to the minimum of discrimination in types of meetings, perhaps he will assent to our suggestion that he writes a second one, culled from his wide experience, which will cover such widely separated gatherings as public, board, joint-consultation, technical and social sub-committee meetings, and do so logically.

* "So You're going to a Meeting" by Walter Puckey; published by the Institution of Production Engineers, 10, Chesterfield Street, London, W.1. Price 5s. 4d. post free.

Institute of Australian Foundrymen

The second convention and exhibition of the New South Wales division of the Institute of Australian Foundrymen was held in Sydney from August 30 to September 3. After a buffet luncheon at the University, the convention was opened by Professor A. V. Stephens, M.A. (Cantab.), and following his address there was an inspection of the aeronautical laboratory. In the evening, two papers were presented, the first by H. E. Greenbank, "Development of Synthetic Sand for Ferrous Castings" and the second—an exchange paper from the Institute of British Foundrymen—by Mr. T. H. Weaver, "Aspects of Selective Grading of Sands for Shell Mould and Shell Core Production."

Next day (Wednesday), there were works visits to Babcock & Wilcox of Australia Pty. Limited and the Australian Aluminium Company. In the evening, the second part of Mr. Weaver's paper, "Improved Methods of Shell Moulding," was presented. This was followed by one from Mr. R. S. McLaughney and Mr. R. Cecil on the "Manufacture of Cast-steel Bull Gears by the Centrifugal Method." Thursday was devoted to visiting the exhibition, whilst in the evening there was a supper dance. At the final technical session on Friday, there was a discussion on the pH control of foundry sands followed by two papers—by Mr. A. N. Waterworth on "Marchagee (W.A.) Bentonite as a Bonding Agent in Synthetic Foundry Sands," and Mr. E. C. Zirzon on "Sand Control for the Average Jobbing Ferrous and Non-ferrous Foundry." This was the American Exchange paper. The convention closed with an official supper.

Institute of Metals

The Institute of Metals Autumn Meeting opened at Buxton, Derbyshire, last Monday, September 19. The Sheffield branch of the Institute is host to the conference and the reception costs have received generous donations from Sheffield and South Yorkshire industries. The opening discussion on Monday was on transformations in copper alloys from the basis of papers by Dr. R. Haynes, who carried out research on this subject in Sheffield University Department of Metallurgy. Other speakers included Professor R. W. K. Honeycombe, Professor of Physical Metallurgy at Sheffield.

The annual Autumn Lecture of the Institute was given in the Firth Hall of Sheffield University on Tuesday, on "Development and Improvement of Research Techniques," by Dr. C. Sykes, managing director of Thos. Firth & John Brown, Limited. The programme includes the Institute's banquet to-day, when the Lord Mayor of Sheffield, Alderman J. Curtis, presides. Together with him in the reception of the guests at the banquet are listed the Master Cutler, Mr. W. G. Ibberson, and the president of Sheffield Chamber of Commerce, Mr. F. A. Hurst. Delegates to the meeting include visitors from the United States, Japan, Australia, Spain, France, Holland and Switzerland.

THE COMBUSTION ENGINEERING ASSOCIATION is acting as joint sponsor with the National Industrial Fuel Efficiency Service of the Fuel Efficiency Exhibition, which is being held at the City Hall, Manchester, from October 12 to 22. In connection with the exhibition, the association has arranged to hold a conference in the Conference Room, Campfield Avenue, Deansgate, Manchester, on October 13 and 14, on "The Cost of Steam." It will show how the cost of steam in generation and utilization may be readily assessed and demonstrate what economies can be made.

Stanton Apprentices' Camp

For the majority of those who have left school this summer the graduation from classroom to office or factory has presented a big stride in their lives and one that is not always easily taken. To aid those boys, between the ages of 15 and 16 who join the Stanton Ironworks Company, Limited, in these problems, a camp has been arranged in the Lake District at the company's expense.

The boys will be sent for four weeks to the Brathay Hall camp, near Ambleside, where their stay is designed to promote self-confidence, discipline, and leadership.

Older boys with the company are already sent in limited numbers to the Outward Bound school and the company hopes that the new scheme will benefit those who have not had the benefit of a grammar school education. The chairman of Stanton Ironworks, Sir Frederick Scopes, believes that all boys entering industry need a proper initiation "to this new environment of work."

The scheme will cost the company about £2,500 a year. The boys will receive full pay and travelling expenses while they are at camp and, according to the company's training officer, Mr. William Matthews, the cost to the company will be about £30 a boy, plus travelling expenses and wages. The company intends to start later this month by sending 20 boys to Windermere and in a full year about 80 boys will attend the camp.

POA Minibition

The sixth in the series of annual Minibitions which are held in conjunction with the national conferences of the Purchasing Officers Association will be the largest so far. Exhibitors have taken 127 stands covering the whole field of British industry. On the opening day of the Minibition, September 29, visitors will be welcomed and applications for tickets of admission on this day should be made to the Association at Wardrobe Court, 146a, Queen Victoria Street, London, E.C.4. On the opening morning, a panel of independent judges will decide the three best displays. The panel will consist of:—Mr. C. Kenneth Horne, managing director of the British Industries Fair, Limited; Mr. H. J. C. Carte, O.B.E., A.I.E.E., president of the Margate Chamber of Commerce; and Mr. Peter Mytton-Davies, an industrial journalist with considerable display experience. Exhibits will be judged on both their educational nature and the attractiveness of their layout. The winners last year were British Insulated Callender's Cables, Limited.

Latest Foundry Statistics

According to the August *Bulletin* of the British Iron and Steel Federation, employment in the steelfoundry industry on July 9, was 16 fewer than on June 4, when it was 19,915, but generally speaking it is very steady. The average weekly production of steel castings, however, showed some improvement during June at 6,400 tons, as during May it was 5,100 tons and in June, 1954, 5,800 tons.

As reported by the Council of Ironfoundry Associations, the following number of ironfoundry workers were employed in the United Kingdom during the week ending July 30: Males 132,997, females 10,110, making a total of 143,107. These figures disclose that there has been a decrease of 742 during the last month but an increase of 4,439 over a year ago.

Sixth IBF National Works Visits

"Busmen's Holiday" in the Bristol Area

October 7 is the sixth occasion on which the Institute of British Foundrymen has arranged a series of works visits open to members throughout the country. This year the Bristol and West of England branch are acting as hosts and ten works in this area are to be visited by the various parties and there is to be an evening function in the Grand Hotel, Bristol. In order that the intending participants, as well as other readers, will have some idea of the type of firms to be seen, brief descriptions of a number of the firms are given in what follows. In the accounts, an attempt has been made to draw attention to the features which will be of particular interest to foundrymen.

T. H. & J. Daniels, Limited

T. H. & J. Daniels, Limited, was founded in about the year 1840, by Thomas Henry Daniels, great-grandfather of the present chairman, and up to the moment has been in the hands of four generations of the Daniels family. During the war, the firm celebrated its centenary. For a number of years, the firm made ornamental and decorated ironwork, a great deal of which was used in churches for altar rails and screens, in addition to general engineering work. Treadle lathes for metal turning and hand-engraving tools were in use. The engineering business has steadily grown and in the 1860's and 1870's, several beam engines and other steam-engines were produced. About 1870, an iron and brass foundry was started and towards the end of the last century, the firm commenced the manufacture of pressure and suction gas plants, and in 1908 undertook the manufacture of the Gutermuth high-speed spring valve pumps for which a licence was taken out for this country and the British Dependencies. In the early part of the present century, the company made the experimental Still engines, the Hel-Shaw streamline filters, pressure and suction gas plants, tyre-building machines, as well as carrying out the early work on superchargers.

Since the war, many important developments have taken place; additional buildings have been erected; and the employees now number about 620. The various departments of the works include pattern-shop, foundry, plate, tank and welding shops, machine and fitting shops, experimental and development laboratory, raw-material, finished-work, and general stores. The works cover 250,000 sq. ft. whilst the size of the foundry is 11,500 sq. ft. and the employees in the latter number 32.

The company manufactures a wide range of hydraulic presses (up to 250-ton rating) for the rubber and plastic industry and the powder-metallurgy process; injection-moulding machines; die-casting machines; high-speed centrifugal separators; portable chain saws; automatic boiler-control equipment; fans; dust-collecting plant; cupola spark and dust-collectors; water-treatment plant and fabricated steelwork.

The type of foundrywork catered for is as follows:—Jobbing (Fig. 1), 5 lb. to 6 ton; semi-mechanized (Fig. 2), 2 to 56 lb.; copper-base, ½ lb. to 1 cwt.; and light alloys, ¼ lb. to 8 lb. The chief items of plant which will be of interest to the foundrymen are a Sandslinger, a number of moulding machines, cupolas fitted with the firm's own design of spark and dust-collectors, sand-treatment plant, a rotary shotblast machine, and plant for the production of cores and moulds by the CO_2 Process. The firm produces 40 tons of iron castings, 500 lb. of aluminium, 800 lb. of magnesium, and 150-lb. of copper-base alloys per month. A self-contained apprentice training school and workshop was instituted in 1950 to which 16 candidates are admitted annually as craft and engineering apprentices. There is a work-study department and staff have been specially trained for this specialized section. The firm was one of the earliest to realize that blind and physically-handicapped persons can be usefully employed in industry, and during the last twelve years, machine and assembly operations have been efficiently carried out by blind men and women. At present, four blind machine operators are employed.

FIG. 1.—*Jobbing section of the foundry of T. H. & J. Daniels, Limited.*

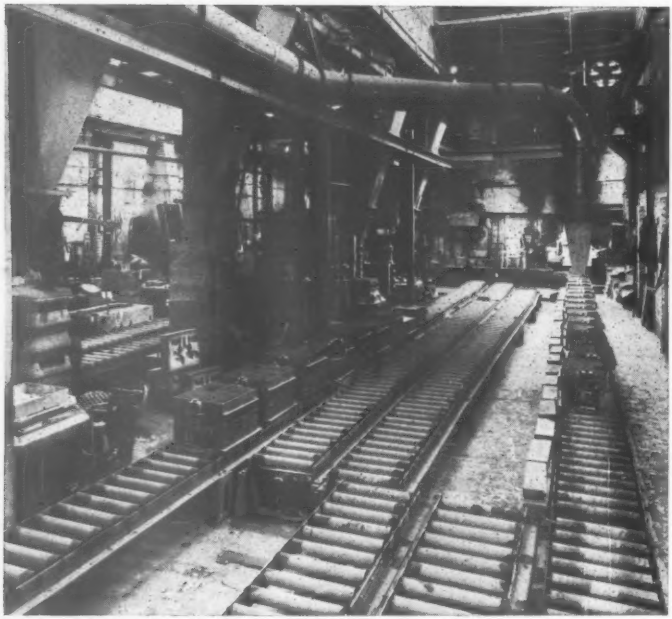


FIG. 2.—*T. H. & J. Daniels' semi-mechanized section, showing the roller conveyor and mould-storage banks.*

Additional premises have recently been acquired locally to which will be transferred the manufacture of portable chain saws, thereby providing for the expansion in the present works to meet the increasing demand of the firm's other products.

Douglas (Kingswood), Limited

Douglas (Kingswood), Limited, commenced as engineers to the boot trade in 1882, and there were then 25 employees. A small foundry for making cast-iron lasts was started in 1883 and the number of employees rose to 35. In 1902, the firm commenced the manufacture of motor-cycles and, during the first world war, production of these was concentrated on War Office demands and the delivery rate averaged 300 per week. From 1919 to 1939, the main products of the firm were a wide and changing range of motor cycles together with a variety of industrial trucks, which latter were introduced in 1931. This period also saw the commencement of a shop for manufacturing aircraft components. The number of employees rose to approximately 2,500 during the second world war and among the items produced then were parts for many well-known designs of aircraft; shell cases, and portable generator-sets. The generators incorporated a suitably adapted 350 c.c. flat-twin motor-cycle engine of the firm's design.

The post-war period has seen the reintroduction of motor cycles and industrial trucks, with the addition of industrial engines. In 1951, work was started on the production of the "Vespa" motor scooter and the weekly output of these has now reached 250/300. The firm's aircraft departments are also fully engaged on the manufacture of parts.

Foundry

The foundry covers an area of 44,000 sq. ft. and the number of employees is 74—53 skilled and 21 semi-skilled. The foundry supplies to the works the following main items: "Vespa" cylinders, heads, fans and fan-casings; cylinders, heads, crankcases, gearboxes and crankshafts for industrial engines and motor-cycles. In addition, the needs of a number of outside customers are catered for, the chief items in this category being machine-tool beds, cylinders and pump ends, castings for automatic machinery and pistons. Work of both a jobbing and mechanized nature is undertaken; the weight range of the former being up to 3¼ tons and the latter to 2 cwt. The weights of castings produced weekly are as follow:—20/25 tons of iron, 2 tons light alloy and ½/½ ton of copper-base.

Moulding plant includes five turnover machines, maximum capacity 36 by 36 in., and three straight-draw machines. This month, an impellor-type sand rammer is being installed. For melting, there are two cupolas of 3 tons per hr. capacity, and a variety of non-ferrous tilting and bale-out furnaces up to 5-cwt. capacity, as well as two small oil-fired reverberatory units. Coremaking plant takes in a 75-lb. capacity coreblower and continuous and stationary drying ovens. There is a quantity of portable and fixed fettling plant of orthodox type, including two shotblast cabinets.

The Douglas works occupy an area of 300,000 sq. ft. and the total number employed is 1,105. The firm takes a very keen interest in its apprentices and has provided both technical and workshop facilities for them. Provision is made for both indoor and outdoor recreational activities and the firm possesses a fully-equipped sports field and club house, the administration being by a committee drawn from all sections of the organization.

Westinghouse Brake & Signal Company Limited

The works of Westinghouse Brake & Signal Company, Limited, at Chippenham, are very extensive and occupy an area of approximately 20 acres. The original works were built in 1895 and have grown by expansion of business and the gradual amalgamation of a number of pioneer firms in the manufacture of railway brake and signalling apparatus.

There are now over 4,000 employees compared with 600 in 1920, and since that time, the floor area has increased by over five times. The factory produces a wide range of intricate products, such as air and vacuum railway brakes of all types; mechanical, electrical and electro-pneumatic signalling of every description; air and vacuum brakes for road vehicles; steam-heating equipment for railways; pneumatic appliances for safe and rapid handling of colliery tubs; metal rectifiers for conversion of alternating current to direct current; and other electrical equipment. The organization of the company consists of a head office at King's Cross, London—where all sales, commercial and research matters and the general direction of the company take place—engineering and design offices at New Road, Chippenham, and the works, Foundry Lane, Chippenham.

Foundries

The foundry organization covers 74,000 sq. ft., comprising patternshops and stores, coreshop, iron, non-ferrous and light-alloy foundries and a die-casting foundry. The number of employees in all the foundry sections is 291. The quantities of castings produced in these foundries per week is as follow:—70 to 75 tons iron, 6½ tons copper-base, 2½ tons iron (ferritic grade), and 10 to 12 tons of light alloys. The weights range from a few ounces to 3 cwt.

In the iron foundry, Fig. 3, chief items of plant of interest to the visitors are the jolt/squeeze and jolt/rollover moulding machines capable of handling 3,000-lb. moulds; three cupolas, two of 36-in. dia. and one of 30-in. dia.; a mechanized sand plant; Prosamas and gyratory riddles. In the non-ferrous section there are jolt/squeeze moulding machines for moulds 15 by 4 by 6 in.; an August Simpson sand mill for facing, fed from the main sand plant; four 450-lb. tilting crucible furnaces and two of 1,000-lb. capacity; and there are the usual facilities in both the iron and non-ferrous foundries for grinding, chipping and shotblasting. Recently the manufacture of spheroidal-graphite castings has led to the purchasing of an electric indirect-arc rocking furnace of 1,000-lb. capacity.

The chief items in the die-casting foundry are as follow: Seven pressure-die-casting machines, including two large machines capable of casting 164 sq. in., and a gravity-die-casting section; eight bale-out crucible furnaces of 150-lb. and 300-lb. capacity, gas-fired; and one 350-lb. rotary furnace for bulk melting. There is the usual machinery connected with die-casting, such as backstand grinders, bandsaw, power presses and a vapour-blast machine.

Future development includes the mechanizing of the light and medium machine-moulding sections, further expansion with s.-g. iron and shell moulding. Special attention in this foundry is drawn to the method of making aluminium patterns and core-boxes by the pressure-cast plaster process (pioneered by their Mr. D. Potts); shell moulding using this type of pattern, and s.-g. iron castings produced from shell-moulds.

Newman, Hender & Company, Limited

The firm of Newman, Hender & Company, Limited, of Woodchester, Glos., was established in 1879, and the number of employees varied from about six to 20 as the business developed. To-day, the firm employs 700 at the Woodchester works, which covers 16 acres. Of this, 45,000 sq. ft. are devoted to foundry work, 51,000 sq. ft. are devoted to machining and assembly and 40,000 sq. ft. to offices, warehouse and storage. In addition, the firm has a subsidiary company (N. H. Engineering

FIG. 3.—*General view of the iron foundry of Westinghouse Brake & Signal Company, Limited.*

Company, Limited), operating at Trowbridge in Wilts, as well as Shipham & Company, Limited, and George Clarke & Sons (Hull), Limited, operating in Hull.

Coreshop

A mixed labour complement (mainly female) is engaged in producing cores of intricate shape and design, both by hand and with the aid of coreblowing machines. The majority of the operators carry out their duties under a specially-built section which can be suitably cooled in summer, or heated in winter, to ensure the best possible working conditions. This assists them to maintain a high standard of efficiency. The department is serviced by conveyors of various types, thus eliminating unnecessary handling to and from the core-drying ovens and to the core-storage department. Cores are made by hand ramming or machine blowing special oil-bonded sand. A recent innovation is a section devoted to shell cores which employs six machines, two of them newly-installed models of American origin (Figs. 4 and 5).

Foundry

The foundry is recognized as a section where a very concentrated and specialized effort must be maintained to produce castings to the specifications and requirements of modern engineering practice, and which have to withstand internal-pressure tests. It consists of an " iron " section and a " bronze " section, both following more-or-less orthodox practice. In the former, the moulds are produced by pneumatic moulding machines, sand being supplied from overhead conveyors located directly over the machines. When each mould is made and removed, the cores are set in place, and the mould conveyed to a casting station directly in front of the cupolas. After pouring, the mould is again mechanically conveyed, this time to the knock-out where castings are removed and allowed to cool, whilst the sand is mechanically reconditioned and returned to the containers by an elevator and an overhead-belt system. In the bronze section, much the same principles are followed, but the metal melting and casting technique, as would be expected for non-ferrous work, receives a higher degree of control and attention to detail to ensure a constant quality of product from the various alloys. All castings are shotblasted in Wheelabrator or Spenstead machines to ensure a smoth, clean finish. The final stage of cleaning and inspection takes place before the castings are ready for the machine shops or for supply to the trade. The main items of production in the iron foundry include valve, pump and cock castings destined, first, to the firm's machine shops, as well as castings for sale to the automobile, electrical and general engineering trades (weight range up to 56 lb.) and, in the bronze foundry, valve and cock castings for the machine shops as well as castings for sale to the general engineering trade and government Service departments (range also up to 56 lb.). Much attention has been devoted recently to shell moulding and machinery installed for this purpose includes two Polygram shell-moulding machines and ancillary plant.

Machine Shop

The machine shop can roughly be divided into three main sections, *viz.*, capstan lathes, automatics and fitting sections, and throughout these a rigid inspection system is maintained to ensure that accurate work only is passed on for further processing. In order to ensure a high degree of interchangeability, gauges are provided for all important operations.

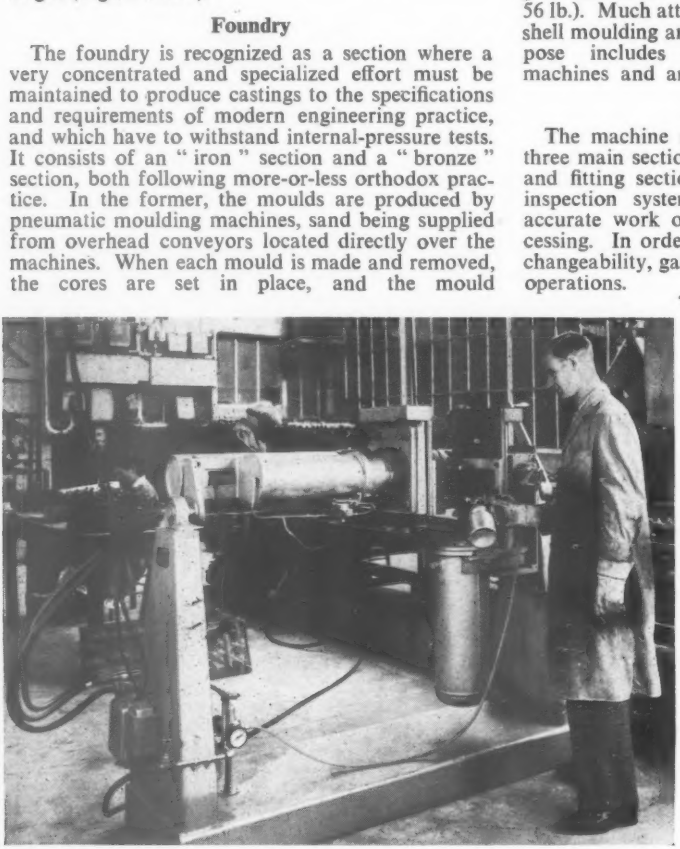


FIG. 4.—*" Shallco " core-blower for shell-coremaking (an American machine) at Newman, Hender & Company, Limited.*

Welfare

A well-equipped ambulance room, under the supervision of a fully-qualified state-registered nurse is available for the use of all employees. The sports and social club, the building for which was completed in 1946, provides all forms of indoor and outdoor recreation. Its activities cover skittles, cricket, tennis, billiards, darts, dances, etc. As regards other welfare activities, the company is well to the forefront of modern thought, and believes it has anticipated future development in many respects.

Charles Hill & Sons, Limited

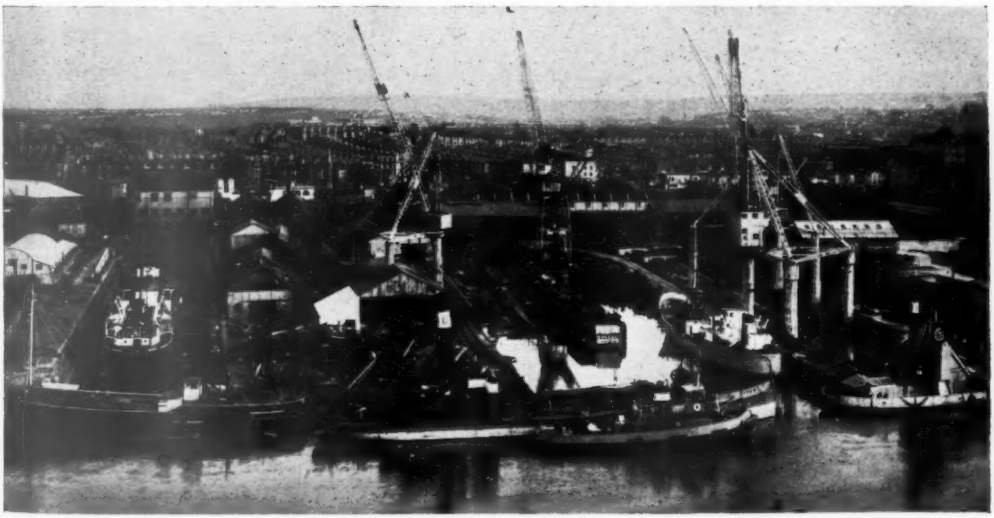
About the year 1710, Mr. James Hilhouse, a successful merchant, became interested in shipowning. His son continued this interest, but his grandson decided to turn his attention to shipbuilding and acquired a dry dock at Hotwell's, Bristol, where he built frigates for the Admiralty and merchant ships for slave-traders. By 1810, Hilhouse had three yards, and it was in that year that Mr. Charles Hill entered the business and became a partner in 1825. The firm's first steamboat was built in 1813 and about this time a house-flag of blue and white was adopted. In 1820, a new dock-yard was acquired on the south side of the river and, here, workers' houses were set up and shipbuilding facilities provided. This is now the site of the present firm. Mr. Charles Hill took over the whole business from Mr. Hilhouse in 1845 and and changed the style to Charles Hill & Sons. The Bristol City Line was started in 1879 with sailings between New York and Bristol. The last sailing ship was built in Bristol in 1895, fourteen years after Hills had built their first iron ship. Shortly after the first world war, the main activities of the business were incorporated into two limited companies, the Bristol City Line of Steamships, Limited, and Charles Hill & Sons, Limited, the latter concentrating on shipbuilding and repairing; since then various other companies have been acquired. During the second world war, Charles Hill & Sons, Limited, were responsible for repairs to over 2,000 ships and built 24 ships for the Admiralty including 8 corvettes and 13 frigates. It was claimed that the speed of construction of river-class frigates was greater than that of any other shipyard in the country. At Bristol, the firm has three building berths each 325 ft. long, and two dry docks, No. 1 being 540 ft. long by 52 ft. wide, and No. 2 322 ft. long by 48 ft. wide (Fig. 6). At Avonmouth, there is a public dry-dock with a length of 875 ft. by 100 ft. wide.

FIG. 5.—*Blowing shell cores on cartridge-type blowers at Newman, Hender & Company, Limited.*

National Smelting Company, Limited

The Avonmouth works of the National Smelting Company lie about one mile north-east of the port of Avonmouth and there are about 1,800 employees on the payroll. Though not a "foundry," the works produces much basic raw material for

FIG. 6.—*View of Albion Dockyard of Charles Hill & Sons, Limited, Bristol.*



IBF National Works Visits

founders and thus the processes carried on have considerable interest for Institute members. The site and existing plants were secured by the company from the Ministry of Munitions in 1924, having been erected during the first world war. The plants consisted, at that time, of ten sulphuric-acid units, two hand-operated Delplace roaster furnaces, and six horizontal-retort zinc furnaces, all in various stages of completion. Only one acid unit had been operated by the Ministry, making the acid from the burning of brimstone. The roasting furnaces were completed and connected to the acid plant, and sulphuric acid was made from the rather weak sulphurous gases evolved from the roasting of Australian zinc concentrates. Two of the zinc furnaces were completed by the summer of 1926, but the general strike and the long coal strike of that year prevented their operation, and it was not until early 1929 that the first plate of zinc was produced from these furnaces. In the meantime, mechanical furnaces for pre-roasting zinc concentrates before sintering, were installed and so also was the first sintering machine. This was quite small compared with the present machines. Further experience of sintering led to the direct-sintering process as used to-day, and the pre-roasting furnaces became obsolete. In this process, desulphurizing and sintering is done in one operation.

The Avonmouth works are well laid-out, with a network of good roads and rail tracks connecting the departments. The products include zinc of various grades, sulphuric acid of several strengths and purity, ammonium sulphate, cadmium, metallic arsenic, aluminium sulphate, hydrofluoric acid, fluorine and fluorides and sulphuric acid catalyst. The main operations are those of producing zinc and sulphuric acid. The company claims to be the only producer of primary zinc in the country, this being produced at their works at Llansamlet.

Sinter and Acid Manufacture

The raw material is finely divided zinc-blende concentrate. Very little zinc-ore is mined in Great Britain and practically the whole of the concentrate is imported. It is transported from the Avonmouth docks into the works by aerial ropeway, Fig. 7, and placed either in a covered store or on a large open-air stock-pile from which it is recovered, as required, by a dragline scraper. Before it can be treated in the furnaces for the recovery of zinc as metal, the zinc sulphide in the concentrate has to be converted to zinc oxide, and the very-fine nature of the concentrate transformed into granular, porous condition. Both are accomplished in the sintering operation, whereby the sulphur is evolved as sulphur dioxide, and the resultant zinc-oxide particles are fritted into lumps with a porous, coke-like structure. The wet sulphurous gases evolved from the sintering machines carry with them some fine solid particles and these gases have to be cleaned and dried before passing over the catalyst in the sulphuric acid-plant converters. This is done in an extensive purification system consisting of wash towers, electrostatic mist precipitators, coke filters and drying towers. At the converters, the sulphur dioxide is converted to trioxide on vanadium catalyst and this trioxide is then absorbed in sulphuric acid of 98 to 99 per cent. strength to form more sulphuric acid. A little—about 2 to 2½ per cent.—of the sulphur dioxide is not converted and this is recovered as ammonium sulphate, a valuable fertilizer, in a final treatment plant before the waste gas is emitted *via* a stack.

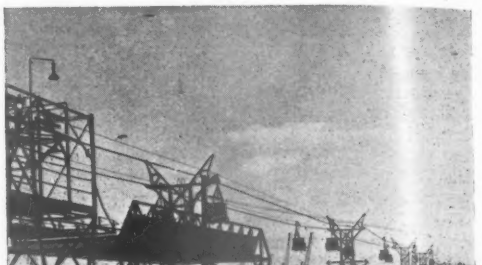


FIG. 7.—*Aerial bucket ropeway connecting quayside and works stockpile. (National Smelting Company, Limited.)*

Metal Production

The sintered ore, then in oxide form, is treated for the recovery of zinc metal in one or two processes, both of which operate at Avonmouth. The older process, using horizontal retorts, is a batch process operating on a 48-hour cycle. The sinter is mixed with anthracite-duff, which provides the carbon to effect the chemical change, and is charged by hand into a series of horizontally placed retorts. These are heated by producer gas and the zinc which is formed as a vapour passes out of the retorts and is condensed in clay vessels outside the heated portion of the furnace. From the clay vessels, the molten metal is tapped at intervals and cast into flat moulds. After 48 hours, the residues are drawn from the retorts and a new charge is put in. The retorts and condensers are made from refractory clays in the pottery department nearby.

The newer process, the vertical-retort process, has been operated at Avonmouth since 1934. It was the first plant of its kind to be erected outside the USA and even now, there are only six such plants in existence, three in America, one in France, one in Germany and the Avonmouth plant, Fig. 8. Though as a process it depends upon the same chemical reactions as occur in the older process, the plants bear no resemblance to each other. The vertical-

retort process is a continuous one and the operations have been mechanized to a large degree. Attached to the vertical-retort plant is a Refluxer unit which refines the zinc produced to a purity of 99.99 per cent. (minimum). This high-purity zinc is that used for zinc-base die-casting alloys. The output of main products amounts to some 60,000 tons of zinc and 130,000 tons of sulphuric acid per annum.

R. A. Lister & Company, Limited

The firm of R. A. Lister & Company, Limited, was founded nearly 90 years ago, in Dursley, by Robert Ashton Lister, the grandfather of the five brothers who comprise the present board of directors, headed by Sir Percy Lister. The founder was knighted for his public services. To-day, with its subsidiary and associate companies, Lister's is a world-wide organization, with manufacturing centres at Stamford in Lincolnshire and Wroughton in Wiltshire, as well at at Dursley. Production began in 1867 in a small smithy—which can still be seen at the Dursley factory. Thus the firm started, in effect, as a miniature foundry, and to-day the huge, fully-mechanized foundry is still the all-important key to production. In 1937, when the foundry was first fully mechanized, it was one of the most modern in Europe. Nowadays, with an increased number of conveyor systems, the mechanization is yet further improved.

Foundry Sections

Of nearly 3,000 employed at the Dursley factory, about 375 work in the foundry, where 400 tons per week of molten iron is poured. The main items in this plant are pneumatic moulding machines of various types—jolt/squeeze, pin-lift and rollover. The sand plant comprises two continuous sand mills each of 25 tons per hr. capacity, the sand being fed to hoppers over the moulding machines by overhead belts and push plates.

In the coreshop, there are 15 women making cores on five core-blowing machines. This team produces 10,000 cores per day, nearly all of which are required for cylinder-head castings. The sand for the coreshop is stored wet in a 175-ton hopper and is mechanically fed to a cyclone-type drier and is then lifted pneumatically for delivery to the core-sand mixers.

Four balanced-blast cupolas of 6/7 tons per hr. capacity are used in pairs on alternate days, the foundry laboratory staff keeping careful control of metal composition as well as of all the sand used for moulding and coremaking. A quite unusual arrangement is that the conveyors carrying the freshly-poured moulds pass through a fume chamber where all gases and steam are extracted—thus maintaining a clean atmosphere in the shop. Emerging from this chamber, the moulds are shaken out on mechanical vibratory screens, and the power-driven hot-castings conveyor takes them direct to the fettling shop. After being treated by rumbler or automatic shot-blast, they are placed on a dual-duty conveyor for individual fettling and inspection, finally passing to the stores, ready for delivery later to the machine shop.

A feature of special interest to the visitors is the elaborate use made of electrical and compressed-air-driven equipment and hoists to maintain the high degree of mechanization throughout the plant.

J. Jefferies & Sons, Limited

The firm of J. Jefferies & Sons, Limited, was founded in 1872 by Mr. John Jefferies, who, later joined in partnership by his sons, carried on the business of general ship-repairers and iron and brass founders at Limekiln Drydock and New Quay Ironworks, Hotwell Road, Bristol. In 1903, the Great Western Railway acquired the site at Limekiln Drydock, and the ship-repairing operations were transferred to the other side of the harbour at Wapping Dock. Mr. Jefferies, in 1900, had previously taken over the workshops and other premises of the Wapping Dock Company at Avonmouth. With the opening of the new Royal Edward Dock at Avonmouth in 1908, the firm acquired a site alongside the Graving Dock and erected new offices and workshops, and to-day these premises are the registered offices and main works of the

FIG. 8.—*Condenser and tapping floor of the vertical-retort zinc plant at Avonmouth of the National Smelting Company, Limited.*

ship-repairing establishment. The existing company was incorporated in 1909, and considerable development and expansion has taken place over the years.

During the two world wars, the company were contractors to the Admiralty and Ministry of Transport, and were engaged in the fitting of defensive armament to merchant shipping, trawler conversions to minesweepers, and passenger liners to troopships. A considerable amount of repair and servicing of oil-tankers was also carried out. In the immediate post-war years, the company was fully occupied on the reconversion of merchant ships for service in their peace-time trades, a necessary preliminary to the resumption of the company's activities as ship-repairers to many of the leading steamship companies operating oil-tankers, refrigerated and general-cargo vessels. Since 1949, the company has operated as a subsidiary of the Bristol City Line of Steamships, Limited, and in association with Charles Hill & Sons, Limited, shipbuilders and ship-repairers also of Bristol (see page 325).

The foundry servicing these shipyards undertakes work of a jobbing nature and occupies an area of approximately 11,000 sq. ft. The number of employees is 14, made up of 7 skilled, 5 semi-skilled, and 3 labourers. Castings are produced in the following metals: Grey iron, copper-base, light alloys, white metal and zinc, with weight ranges of up to 3 tons for iron and up to 4 cwt. for non-ferrous. The chief items of plant in the foundry consist of a sand-blast cabinet 5 by 3 ft.; four coke-fired and one oil-fired non-ferrous furnace; and three cupolas, two of 30-cwt. and one of 40-cwt. capacity.

Bristol Aeroplane Company, Limited

Founded as the British and Colonial Aeroplane Company on February 19, 1910, a little over six years after the Wright brothers' first flight, the Bristol Aeroplane Company, Limited, has progressed from a few small sheds on two acres of ground at Filton to a vast industrial organization with over 100 acres of shop-floor area and an employment roll of many thousands. As aircraft and their engines have steadily become more complex, so have development and production techniques new to the aviation industry been adopted. A good illustration of this is the investment foundry at the engine division of the company.

This foundry is producing turboprop and turbo-jet engine components by the lost-wax precision investment process. The original *raison d'être* of lost-wax casting was the desire to cast intricate shapes; to-day, though intricacy is still demanded, the main emphasis is upon precision. Components can be produced to tolerances of 0.005-in. per in. Research into precision investment casting began at Bristol in January, 1942, the first casting being produced in August that year. The work was at first confined to the laboratory, but a production section was formed in the existing foundry in 1945 and, when facilities there became inadequate, moved into specially built quarters in February 1953.*

The Bristol investment foundry is a clean and bright building, with modern handling and processing equipment and laid out for "continuous-stream" production, from wax injection to final inspection. Highly mechanized, it makes wide use of overhead and roller conveyors. Many machines now in general use for precision investment casting owe their origins to pioneer work at Bristol, at a time when little was known generally about the process. There are ten stages of manufacture which the visitors will see: (1) Making the metal die; (2) making the wax pattern; (3) assembly of patterns into casting

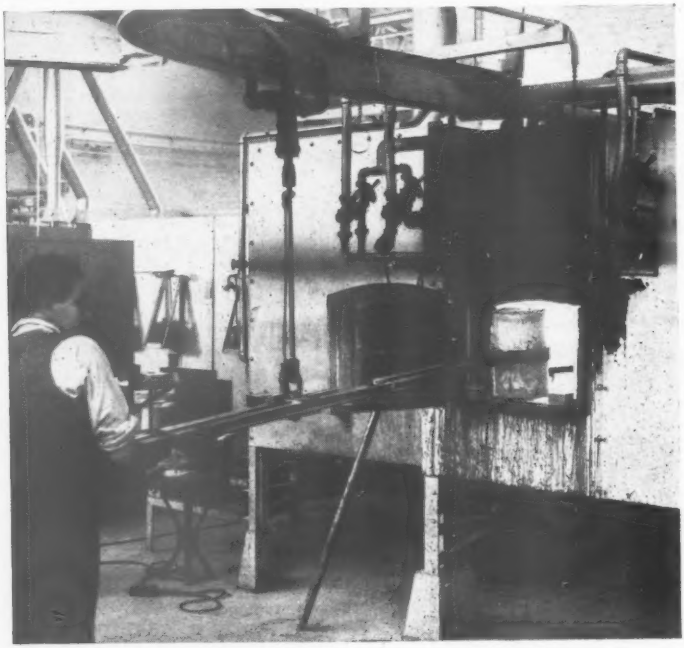


FIG. 9.—*Removal of a cured mould, out of which the wax has been melted, from one of the gas-fired furnaces in the precision casting foundry (Bristol Aeroplane Company, Limited).*

* Members of the Institute will remember Papers given by Mr. D. F. B. Tedds, a past president of the Bristol and West of England branch, in this context.

FIG. 10.—*One of the small invertable electric furnaces in which the metal for precision investment is melted at Bristol Aeroplane Company, Limited.*

formation; (4) applying the primary coating; (5) moulding (or investing); (6) de-waxing; (7) mould firing; (8) casting; (9) removal from the mould; and (10) fettling.

Process Details

The dies for the wax patterns are of machined steel—where durability is needed for quantity production—or of low-melting-point metal—for small numbers only. The patterns are made from dental wax, injected into the dies at 75-80 deg. C. Ideal temperature conditions are automatically maintained in the wax-injection room, for the patterns would otherwise become too soft to handle in summer and too brittle in winter. From the wax-injecting machines, the patterns go to bays where they are sprayed with primary and secondary refractory coatings and then to the adjoining investment room. Here, the coated patterns are invested in standardized containers and the moulds so formed are vibrated to consolidate the investment material and gently heated to melt out most of the wax.

The moulds are then placed on trolleys for firing. The trolleys move slowly through the line of gas ovens and, when the requisite temperature is reached, each mould (still red hot) is taken out by long tongs (Fig. 9) slung from overhead rails, swung round and clamped on top of one of the small electric furnaces (Fig. 10) which stand in line parallel with the ovens. The furnace is inverted and air under pressure helps to drive the metal into the mould, ensuring dense compacting even at the thinnest sections of the casting. The mould is then removed to cool, the investment cement later being chipped away by hand; even at this stage, the high standard of surface finish is apparent. Fig. 11 shows stages in the process. Inspection is meticulous and covers each of the ten stages of manufacture, culminating in final inspection by X-ray and chemical analysis.

The standard of surface finish achieved by the Bristol foundry is extremely high; visitors from the USA say it is better than that achieved by American firms with longer experience. This is due mainly to patented processes used in the application of the primary coating and in the moulding, two points at which the Bristol foundry departs from standard practice. Another noteworthy feature is the foundry's use with the refractory moulding material of ordinary Portland cement and water as the binding agents. This is cheaper and safer than the ethyl silicate and alcohol originally used, and cheaper than sodium silicate and water.

As experience has increased, so has the use of lost-wax casting widened in the Bristol foundry and to-day the investment foundry is playing an important part in the development and production of such Bristol engines as the Proteus (power unit of the Britannia airliner), the Olympus (which in August broke the world altitude record) and the Orpheus (power unit of the Gnat light fighter acclaimed the simplest and cheapest turbojet engine in the world).

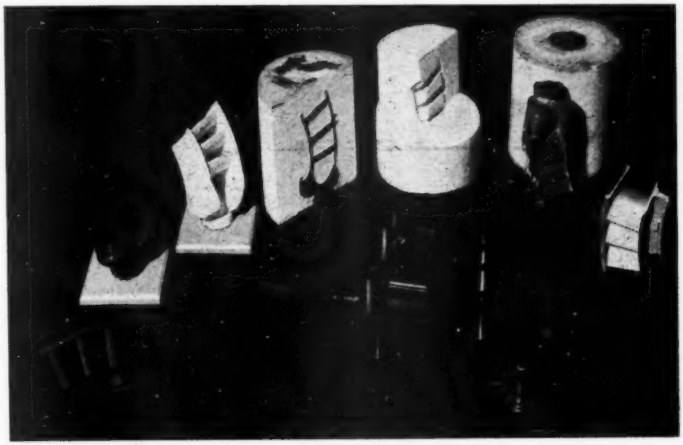


FIG. 11.—*Reading clockwise from bottom centre are shown various stages in making a precision-investment casting: Die, wax pattern, pattern invested, mould, casting and finished component.* (*Bristol Aeroplane Company Limited.*)

German Training Schemes

At a conference in Birmingham, on September 6, arranged by the West Midland group of the British Association for Commercial and Industrial Education, at which industrialists who have recently visited Germany, gave their impressions, it was stated that apprentice training schemes of German industry are more efficient that those in this country. An appeal was made for British industrialists to study German methods and adopt the good points while discarding those that would not accord with British social philosophy and national character.

Mr. D. R. Adams, assistant director of training for Tube Investments, Limited, said that the German apprentice learned as much during his three-and-a-half-year course as the average British youth learned in five years. German apprentice training was no better than ours at its best, but their average standards were considerably higher. It was often said of British industry that it did not pay to be a skilled man because there was no incentive for ability. Skill was paid for in Germany and in addition there was tremendous social pride and prestige in being a skilled craftsman.

A feature of the German system that was noted by speakers at the conference, was the standardization of training and examination methods for apprentices which ensured comparable qualifications and skills no matter where the training was carried out. One speaker said it took his firm five years and cost £2,000 to train an apprentice. Was industry to recognize as similarly qualified a lad who may have been indentured with somebody in a back street and had merely "served his time?" There was no uniformity in the British apprenticeship scheme and no guarantee that an apprentice who completed his time emerged as a qualified craftsman. Mr. J. Wilson, principal of the Birmingham College of Technology, said that there were few square pegs in round holes in industrial Germany. They had solved very successfully the problem of putting people into the jobs for which they were suited. Another speaker noted that some 600 different trades were registered in Germany, many of them jobs that would be given to unskilled men in Britain.

Rhodesia and Nyasaland Trade

When he addressed the Birmingham Chamber of Commerce on September 12, Mr. George Austin, president of the Chamber of Commerce of Fort Victoria, Southern Rhodesia, said that there was a risk of British manufacturers becoming complacent about the privileged trading conditions they enjoyed with the Federation of Rhodesia and Nyasaland, as the result of the tariff concessions for British manufacturers. Duty on British goods imported into the territory was only 5 per cent. compared with 40 per cent. on foreign goods and 20 per cent. on other Commonwealth and "most favoured nation" articles. "British manufacturers should not sit back and relax under these conditions." Mr. Austin said that foreign industry was very conscious of the importance of the federal market, and to overcome the unfavourable tariff they were setting up industries and factories inside the federation. German, Belgian, French and Portuguese firms and those of other nationalities were establishing themselves. At the moment no fewer than six foreign organizations are considering opening up in Central Africa. Moreover, Rhodesia had recently received trade missions from Germany, Scandinavia, Australia and France. He thought Britain too should send out trade missions. He stressed that it was up to British industrialists to visit Rhodesia, size up its great potential and take part in the development that was ahead.

Gas-from-Oil Agreement

An agreement has been signed between the British Petroleum Company, Limited, and the South Eastern Gas Board for the production of town's gas from oil in a plant to be erected by the board at the company's Kent oil refinery, Isle of Grain. The British Petroleum company are granting a long lease of a site which will be sufficient for the construction of oil gasification plant up to a daily capacity of 80 million cub. ft. If the plant is developed to this extent it will be equal in output to the largest gas works in the area.

In the first stage, gas will be produced on the scale of 15 to 20 million cub. ft. a day, with a saving of about 300,000 tons of coal a year. The quantity of oil to be used in the first stage is estimated to be 60 to 70,000 tons a year. Orders will be placed by the Board as soon as possible for four oil gasification units and these should be completed in two to two-and-a-half years. Experiments have shown that the Segas plants developed by the Board can convert into gas a wide range of oil products. The agreement, which is for a period of 20 years, is intended to lead to a close working relationship with the refinery in order to use whatever oil products are available to the best advantage of both parties.

Mains will be laid from the Isle of Grain to Strood in Kent to feed the gas into a trunk main system through which gas will be distributed South of the Thames from Sittingbourne in the east as far as Guildford in the west. The new plant will be the first in the country to use oil products on a large scale as the only material for gas production. It may prove to be significant as the point of departure from the long tradition of the gas industry in relying on coal as its main raw material.

Another Steel Output Record

The Iron and Steel Board announced on September 15 that steel production in August was the highest yet achieved in that month. Production averaged 345,100 tons a week, which compares with an average of 325,600 tons in August, 1954.

Pig-iron production averaged 236,200 tons a week, compared with 227,400 tons a week in the corresponding month of last year.

Latest steel and pig-iron output figures compare as follow with earlier returns:—

Period.	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
1955—June ..	216,800	11,274,000	364,200	18,939,000
July ..	230,800	₱2,000,000	307,700	16,002,000
August ..	236,200	12,282,000	345,100	17,946,000
1954—June ..	233,200	12,129,000	371,700	19,328,000
July ..	211,200	10,984,000	263,100	13,682,000
August ..	227,400	11,823,000	325,600	16,932,000

BRITISH OXYGEN COMPANY, LIMITED—The directors have declared an interim dividend on £8,117,698 ordinary stock of 6 per cent. on account of the nine months ending September 30, 1955, payable on October 15 to holders registered on September 8. By reason of double taxation relief, the net UK rate payable by the company is estimated at 7s. 2d. and this is the rate to which any relief or repayment to a stockholder is limited.

Effect of Mould Material on the Solidification Rate of Cast Metals*

Combined Report of IBF Sub-committees T.S. 21, 33 and 46†

(Continued from page 298)

Sand Grain-size and Other Properties in Relation to Cooling Power

Having now obtained a method of producing a uniform mould and investigated the effect of ramming density on the solidification time, the next variable to be studied was sand grain-size and distribution. The sands selected as being typical of English sands are given in Table II. These were first given a physical examination, the results of which are given in Figs. 9 to 14, and Table III, Fig. 9, showing the results of microscopic examination; Fig. 10, mechanical analysis and angularity data; Fig. 11, sieve tests; Fig. 12, permeability; Figs. 13 and 14, dry-strength; and Table III, chemical analysis.

TABLE II.—*Properties of Typical English Moulding Sands.*

Geological source and Code.	Grain size.	Nature of Grain.	Percentage and type of clay.
Triassic (Bunter sands)			
Hensall ..	Medium to coarse..	Sub-angular	Circa 8
Bromsgrove ..	Medium	Sub-angular	Circa 11
Mansfield .	Fine	Sub-angular	Circa 12
Tertiary sands			
Erith (medium)	Fine	Sub-angular	10.5
Lower Greensand			
Redhill ..	Coarse	Sub-angular	3½ (bentonite)
Redhill ..	Medium	Sub-angular	3½ (bentonite)
Redhill ..	Fine	Sub-angular	3½ (bentonite)
Glacial sand			
Chelford ..	Medium to fine ..	Rounded ..	3½ (bentonite)

Tests were carried out on these sands over a range of ramming densities, using again the 6- by 6- by 1-in. plates. The results are given in Figs. 15, 16, 17 and the following conclusions can be drawn from them.

(1) Cooling power increases with increased ramming density for all the sands investigated.

(2) The coarser the grade of sand the greater its cooling power.

(3) Over the range of densities investigated, sands with high permeability tend to have a higher cooling power than sands of low permeability.

(4) The addition of fines to a coarse sand reduces the influence of ramming density on the cooling power of the sand.

(5) There appears to be no real connection between the dry-strength of a sand and its cooling power. This is a conclusion drawn from data of a number of tests and can be substantiated by studying Figs. 13 and 14 in conjunction with Figs. 15, 16 and 17.

Moisture Content

The next variable to be investigated was moisture content. The preliminary work showing the effect of moisture content on the cooling power of Bromsgrove red and black sands was of sufficient importance to prompt further work on green-sand, using the 6- by 6- by 1-in. plate castings. This was designed to show the effect of moisture content over the workable moisture range in synthetically bonded Redhill sands (*a*) fine (*b*) coarse, each at high and low ramming-densities. In the case of the fine sand, the practicable limits of workable moisture contents were found to be from 3 to 4 per cent. and in that of the coarse sand 2 to 3 per cent.

The results, applying to synthetic sand only, are shown in Fig. 18 and the following conclusions were drawn from them:—

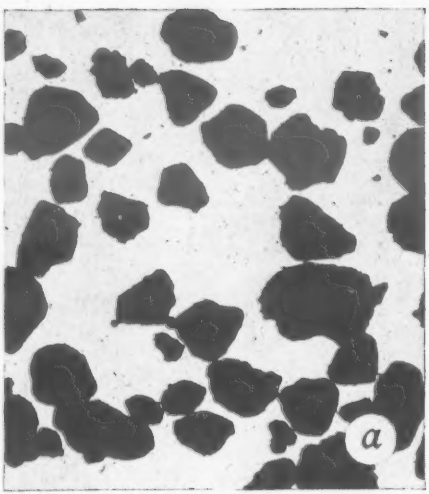
(*a*) The presence of moisture in a sand increases its cooling power.

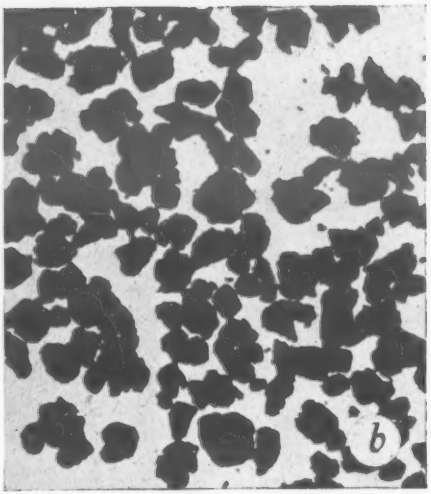
* Presented at the fifty-second annual meeting of the Institute of British Foundrymen and International Foundry Congress in London last June.

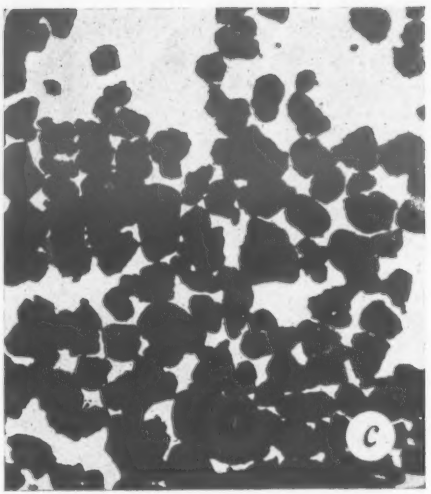
† The constitution of the sub-committees was published last week.

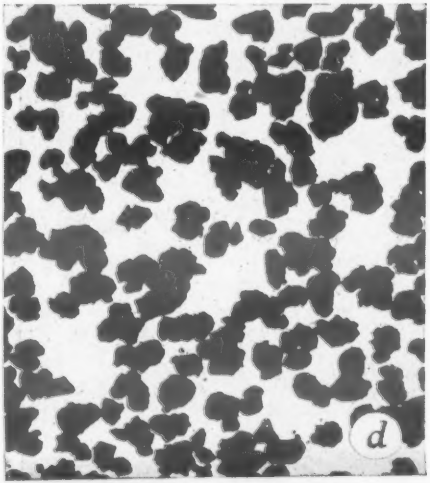
TABLE III.—*Chemical Analyses of British Sands Selected.*

Code.	—	SiO_2	Al_2O_3	CaO	MgO	TiO_2	Fe oxides, Fe_2O_3, FeO	Alkalis, Na_2O, FeO	MnO	Loss on ignition (CO_2, water)	"Clay," per cent.
	Synthetic sands (unbonded):										
14/28	Redhill, coarse ..	99.1	Tr.	—	—	—	0.11	0.23	—	—	—
F	Redhill, medium ..	99.1	Tr.	—	—	—	0.11	0.23	—	—	—
H	Redhill, fine	98.7	Bal.	—	—	—	0.1	0.011	—	—	0.3
G	Chelford, medium-to-fine	93.31	4.48	0.67	Tr.	Tr.	0.68	—	—	0.49	0.7
	Natural sands:										
B.1	Hensall, medium-to-coarse	86.05	7.55	0.48	Tr.	0.22	1.34	2.99	Tr	1.08	8.1
B.2	Bromsgrove, medium ..	84.9	6.69	0.29	0.43	0.4	1.43	3.81	—	1.76	11
B.3	Mansfield, fine ..	82.3	4.85	2.24	1.48	0.16	1.31	2.31	—	4.34	12.6
T	Erith (medium), fine ..	84.77	11.40	Tr.	—	—	2.27	0.56	—	1.0	10.72









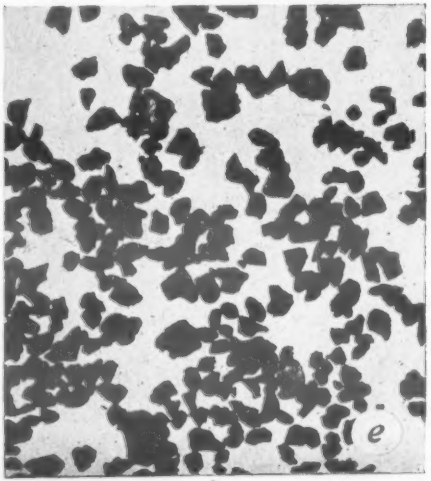


FIG. 9.—*Grain size and shape of typical English moulding sands; all photographed under transmitted light at a magnification of* × 27.5.

(*a*) Sand B1—Bunter sand (Hensall), showing reasonably closely graded grains of sub-angular nature. The clay film is very thin (8 per cent.), so much so that certain grains appear more translucent than others; washed.

(*b*) Sand B2.—Bunter sand (Bromsgrove), showing grains of various sizes (skew distribution) and of sub-angular nature; some grains have thin clay film; washed.

(*c*) Sand B2B.—Similar to B2, but with 8 per cent. addition of superfine coal-dust; grains have a darker appearance due to this; washed.

(*d*) Sand B3.—Bunter sand (Mansfield), fine skew distribution type; the clay content is the highest of Bunter sands examined and hence gives dark appearance to the grains; washed.

FIG. 9 (*continued*)

FIG. 9 (*continued*)

(*e*) Sand T.—Tertiary sand (Erith), a close graded sand with very angular grains (sedimentary fragments); the bond is less ferruginous than that of the Bunter sands, and thus is of lighter appearance; washed.

(*f*) Sand 14/28.—Lower greensand (Redhill) a close-graded, fairly angular sand; several stained grains; unwashed.

(*g*) Sand F.—Lower greensand (Redhill); a wide-graded angular sand; some stained grains; unwashed.

(*h*) Sand H.—Lower greensand (Redhill) a close-graded, very angular sand of relatively clean grains; unwashed.

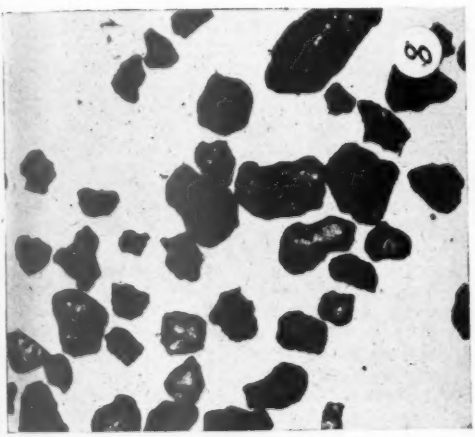
(*i*) Sand G.—Glacial (Chelford), fine, fairly-close graded grains, of rounded nature; relatively free from staining; unwashed.

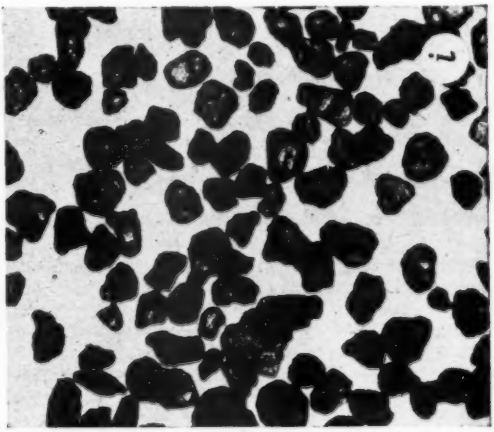
(*b*)* A given moisture content has a somewhat greater effect on cooling power in a fine sand than a coarse sand, over the range of ramming-densities investigated.

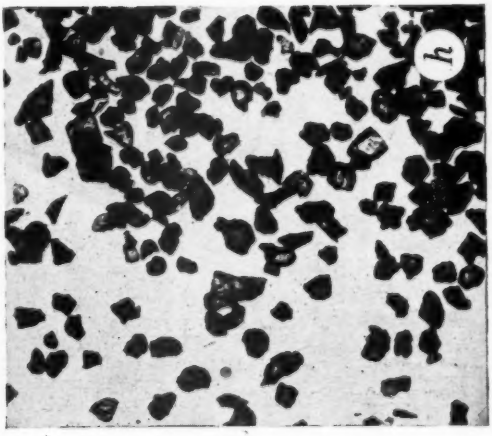
(*c*)* In a coarse sand at higher ramming-density, the variation in moisture content has little or no effect on the cooling power.

These experiments showed the effect of the presence of moisture in a fine, synthetic sand. It was next decided to determine the effect of moisture content on the cooling power of a fine, natural sand, and Erith medium loam was selected for this work. The selected range of moisture contents was from 5 to 8 per cent. and the results are shown in Fig. 19. The observations previously obtained with Bromsgrove sand, as shown in Fig. 8, were also

* Conclusions (*b*) and (*c*) are subject to the effect of casting size which is discussed later.







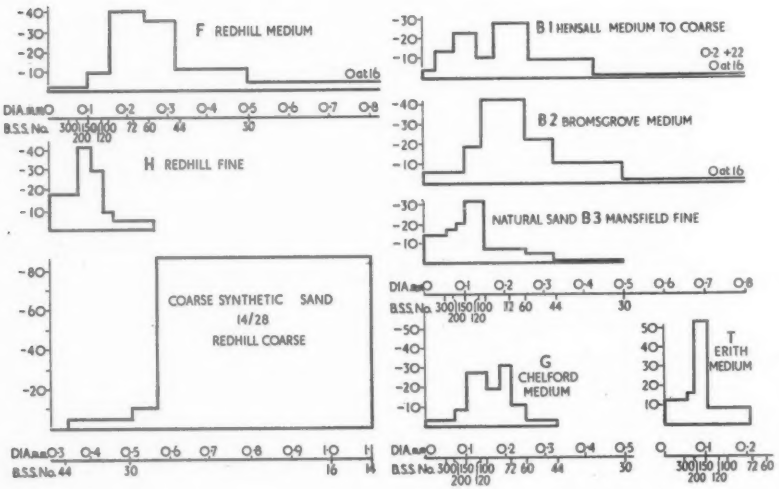


FIG. 10.—*Mechanical analyses in histograph form for the sands shown in Fig. 9.*

taken into consideration, and the following conclusion drawn:—

(*a*) Naturally-bonded sands show the same general tendencies as synthetic sand, with one notable exception. At high ramming-densities, the moisture has considerable effect on the cooling power of fine, synthetic sand, and little or no effect on fine, natural sand.

Influence of Casting Size on Cooling Power of a Green-sand Mould

Other investigators[3,4] have indicated that the difference between cooling power of "green" and dry sands varies with time, owing to the effect of the drying out of the mould by the metal immediately after pouring. In other words, castings of different sizes in a green-sand mould will cause the mould material to exhibit varying cooling powers due to the amount of drying out during solidification. It was therefore decided to study this effect in green-sand moulds at extreme ramming densities, using synthetic sands of coarse and fine grain-sizes and 6- by 6- by 3-in. blocks, this being the heaviest casting for which facilities were available. Moisture contents adopted were 2.5 per cent. for the coarse and 3.5 per cent. for the fine sand. These blocks were gated and risered in the same manner as the 6- by 6- by 1-in. plates and were made in three-part moulds using 3½- by 12- by 12-in. boxes. The centre box was moulded in the following way:—The side walls of the mould cavity were carefully hand rammed, using a weighed amount of sand around the wooden pattern. A weighed amount of sand was then moulded into the ½ by 12 by 12 in. space above the pattern. The other two boxes were rammed by the same method as that used for the 1-in. plate tests. Hand ramming was again used for the high-density test moulds and machine moulding for those of low density. A thermocouple of similar type to that used previously was employed, except that the twin-bore alumina insulation was extended into the centre of the casting. The results of these experiments are shown in Fig. 20.

Conclusion:

In castings of the larger thicknesses, the increase in cooling power of the sand due to the presence of higher moisture percentages is maintained for *Hard*-rammed fine sand and *Soft*-rammed coarse sand. In the case of *Soft*-rammed fine sand and *Hard*-rammed coarse sand, this increase in cooling power due to the presence of higher moisture content seems almost to disappear in larger casting thicknesses.

The comparison between solidification times of block castings 1-in. and 3-in. thick for different sand and mould conditions can be more clearly shown by plotting the logarithm of the solidification times against the logarithm of the volume: surface-area ratio as shown in Fig. 21 and referred to in the later comments on the results.

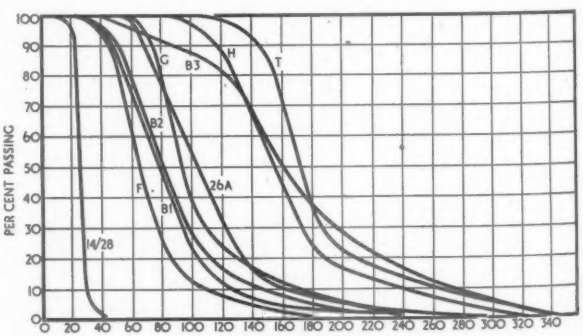


FIG. 11.—*Mechanical analyses in cumulative form of the British sands selected.*

14/28 Redhill, coarse; 2A Arnolds; F. Redhill medium; B1 Hensall, medium to coarse; B2 Bromsgrove, medium; G. Chelford, medium to fine; 26A Arnolds; B3. Mansfield, fine; H. Redhill, fine; and T. Erith (medium), fine.

Influence of Casting Size on Cooling Power of "Green" and Dry Sands Containing Coal-dust

A difference in overall cooling power for different casting thickness could similarly be anticipated with sand containing coal-dust in the presence or absence of moisture. In addition to the castings 3-in. and 1-in. thick, others ½-in. and 1½-in. thick were made, gated and risered in the usual manner. The ½-in. plate was moulded in the drag, the thermocouple being buried in the cope, whilst the 1½-in. plate had a mould cavity consisting of a ½-in. plate in the drag plus the 1-in. centre-frame as used for the 1-in. castings. Initially, it was hoped to study hard- and soft-rammed sands for all plate thicknesses, but as this proved too time-consuming, only medium-rammed sands were studied, and the castings were made in:—(*a*) Dried Bromsgrove sand; (*b*) dried Bromsgrove sand, plus 8 per cent. superfine coal-dust; and (*c*) "green" Bromsgrove sand at 6.5 per cent. moisture and 8 per cent. superfine coal-dust. It should be pointed out that the coal-dust additions were made to virgin red sand, and the results do not show the cumulative effect of repeated coal-dust additions to the same sand, or the effect of coal-dust additions to "black" sand.

TABLE IV.—*Comparative Solidification Experiments on 6- by 6-in. Plates in Cast Iron and Aluminium-bronze.*

Plate thickness.	Sand.	Moisture, per cent.	Ramming density, gm. per c.c.	Solidification in seconds.	
				Cast iron.	Al-bronze.
½	Bromsgrove red	6.5	1.49	130	125
1	,,	6.5	1.49	395	355
3	,,	6.5	1.49	1,222	—
½	Bromsgrove black	6.5	1.49	130	125
1	,,	6.5	1.49	355	325
3	,,	6.5	1.49	1,002	1,020

The results of the experiments are shown in Figs. 22 and 23 and the following conclusions can be drawn:—

(*a*) The increase in cooling power produced by coal-dust additions to dry sand, reported in experiments with 1-in. thick plates is not maintained and coal-dust actually appears to have an opposite effect on plates of 1½-in. thickness and above.

(*b*) The increase in cooling power produced by coal-dust additions to green-sand was maintained over the whole range of plate thicknesses investigated.

Experiments with Cast Iron

For the reasons already given, most of the data given in this Report have been obtained using aluminium-bronze. It was thought desirable, however, to carry out some comparative experiments using cast iron, for the following two reasons: (*a*) to compare the time of solidification of the two alloys in identical moulds and (*b*) to demonstrate that mould variables would produce similar effects with cast iron as were obtained with aluminium-bronze.

Identical moulds were prepared in Bromsgrove red sand with and without coal-dust additions at 6.5 per cent. moisture, and plates of varying thickness were cast in aluminium-bronze at 1,250 deg. C., and cast iron at 1,270 deg. C. The cast iron had the following composition: C, 2.72 per cent.; Si, 1.96 per cent.; Mn, 0.91 per cent.; P, 0.12 per cent.; and S, 0.04 per cent.; and the time of solidification was taken as the time to cool to 20 deg. C. below the eutectic arrest. The results are given in Table IV.

Two major conclusions appear from these results:—

(*a*) The view is confirmed that the freezing times of castings made in aluminium-bronze are closely similar to those of iron castings (because of the similar heat contents of the two alloys over a similar range of pouring temperatures); and (*b*) the black sand has greater cooling power than red sand with either alloy.

On the basis of these results, it does not appear that any new light on the comparative cooling power of different sands and in different conditions would have been obtained if cast iron were used throughout the work instead of Al-bronze. Consequently, it is thought that all major conclusions reached in this work would also hold for cast iron, but the exact values for solidification times may be numerically somewhat different for the two alloys.

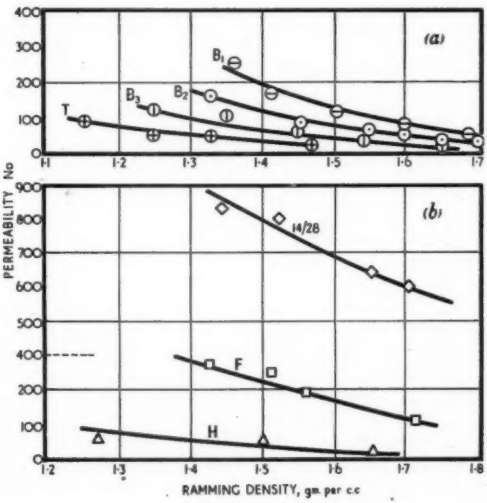
COMMENT ON RESULTS

The following is an attempt to give a physical explanation of the variations in cooling powers of the various sands studied in this work.

Simplified Theory of Heat-extraction in Moulds

Various workers[1 2 5] have shown that the heat

FIG. 12.—*Permeability values for the sands shown in Fig.* 11, *according to ramming-density,* (*a*) *for the naturally-bonded sands and* (*b*) *synthetic sands.*



removed in a given time by a dry-sand mould from a casting is proportional to the difference between the temperature at the metal/mould interface and the initial temperature of the mould and to a quantity known as the heat diffusivity b which is defined in the following equation:—

$$b = \sqrt{(\text{a.t.c.})^* \times (\text{specific heat}) \times (\text{density})}$$

The term "apparent conductivity" is used in the above equation because the transfer of heat in a sand mould takes place in several ways,[6 7 8] part of it being transferred by a true conduction mechanism and part by radiation of heat between and through the sand grains. In the present work, the interface temperatures were substantially the same during the freezing period of the castings and similar in all the experiments and need not be further considered.

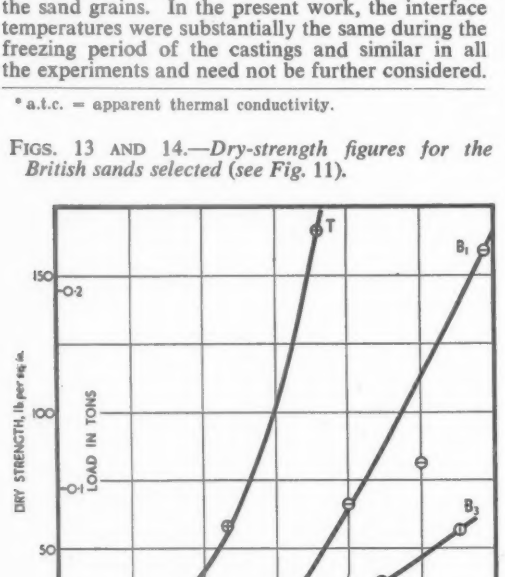
* a.t.c. = apparent thermal conductivity.

It may be shown [5] that, neglecting corner and surface-curvature effects, the solidification time of a casting in a particular alloy (*i.e.*, constant interface temperature) should be approximately proportional to $\frac{1}{b^2}$

Effect of Ramming Density

The work described in the Report shows that an increase in the ramming density of a given moulding material produces a quite substantial increase in the cooling power. In some instances, decreases of as much as 25 per cent. in the freezing time of the test casting were recorded (Figs. 15, 16, 17). It is clear from the theory briefly described that such an increase is to be expected because the density of the mould enters into the term b, and it may in fact readily be shown that the increases in the densities of the mould can account for most of the decreases recorded in the freezing times of the test castings.

FIGS. 13 AND 14.—*Dry-strength figures for the British sands selected (see Fig. 11).*



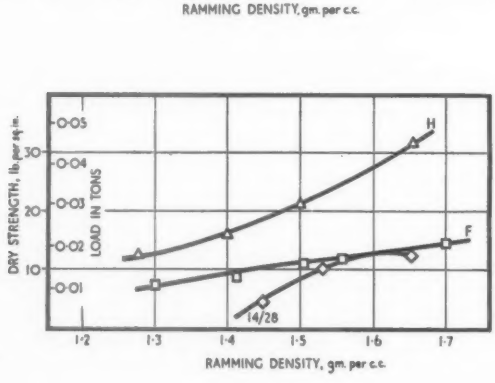


FIG. 15.—*Effect of ramming-density on the cooling-power of synthetic sands; 14/28 (Redhill, coarse); F. (Redhill, medium); H. (Redhill, fine), and G. (Chelford medium to fine).*

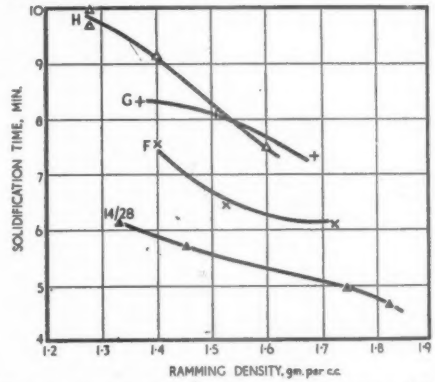
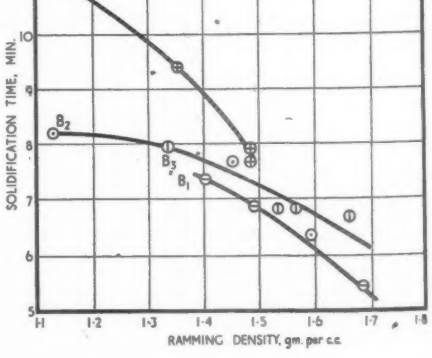


FIG. 16.—*Ramming-density/cooling-power relationship for natural sands: B.1. (Hensall, medium to coarse); B.2. (Bromsgrove, medium); B.3. (Mansfield, fine), and T. (Erith, medium).*



However, in one or two instances the decrease in freezing time was rather greater than would be expected from consideration of the density alone. For example, in the case of the top curve in Fig. 15, a decrease in freezing time of 23 per cent. occurred when the ramming density was increased from about 1.27 to 1.60. This change in density should *per se* produce a decrease in freezing time of only 21 per cent. The difference between these two figures is not large and may possibly be due to experimental error, but other workers (discussed in reference[5]) have shown that an increase in rammed density may also increase the apparent thermal conductivity and any such effect will be additive to the effect of density by itself, since both the density and the thermal conductivity enter into the heat diffusivity.

The results presented in Figs. 22 and 23 show that an addition of coal-dust to the sand caused some increase in the cooling power of the mould in the case of castings of fairly light section (less than 1½ in. thick). This result is in agreement with the work of Dunphy and Pellini,[7] who suggest that coal-dust increases the cooling power of a mould because volatile products of the decomposition of the coal are distilled off near the metal/mould interface and re-deposited further away, thereby increasing the transfer of heat outwards from the interface. It is also possible that the coal-dust blackens the sand grains, increasing their emissivity and hence the proportion of heat transferred by radiation rather than by true conduction. Such an increase should result in an increase in the apparent conductivity.[6]

Anomalous results were obtained with the larger sizes of plate, in that the cooling power of the sand containing the coal-dust was less than that of the plain Bromsgrove sand. These results would not appear to be in agreement with the work of Dunphy and Pellini.[7] Since only a few tests were made, this result cannot yet be regarded as being firmly established. However, it should be borne in mind that as very little is known about the distillation and exothermic processes which take place in moulds containing coal-dust, the effects of section thickness, such as those observed in the present work, may well be real.

Effect of Sand Grain-size

The results presented in Figs. 8, 15 and 16 show that the cooling power of a mould increases with increase in the grain size. The increase in cooling power found with coarser sands is probably largely due to an increase in the apparent thermal conductivity of the mould. It has been suggested by Atterton[6] that this effect is largely due to an increase in the contact area between the sand grains, as in a coarse sand illustrated in Fig. 24. Fig. 17 shows that the presence of a certain amount of fine material in an otherwise coarse sand causes a slight decrease in chilling power. The reason why the addition of a small amount of fines results in a decrease in cooling power is possibly that the fines wedge the larger grains further apart, thus decreasing the area of contact—this is also indicated in Fig. 20. Fig. 21 also indicates that a high ramming

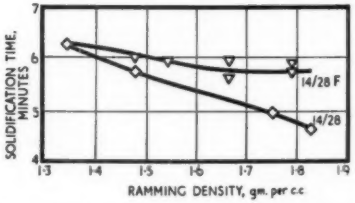


FIG. 17.—*Effect of fines on the relative cooling power of sands* 14/28 (*Redhill, coarse*) *and* 14/28 *F.* (*Redhill, plus fines*).

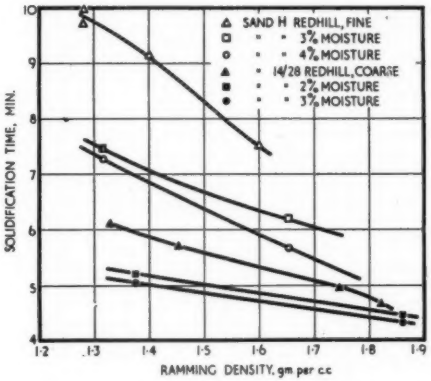


FIG. 18.—*Effect of moisture on cooling power of synthetic Redhill sands, H.* (*fine*) *and* 14/28 *coarse.*

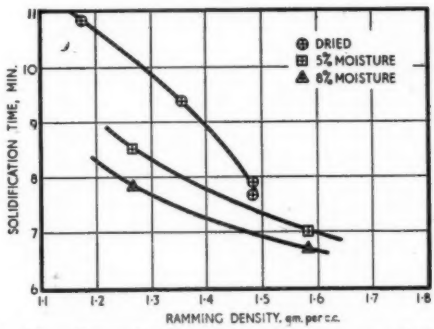


FIG. 19.—*Ramming-density/cooling power relationship, with varying moisture content for fine, natural sand—T.* (*Erith, medium loam*).

density might be expected to increase the cooling power of a coarse sand but to have little effect on the same sand when a quantity of fines is present. It will be observed that the results presented in Fig. 17 confirm this view.

The picture presented thus is possibly rather too simple, in that an increase in the grain-size of a sand may affect the amount of heat transferred by

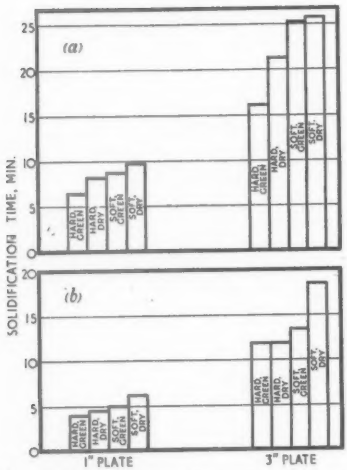


FIG. 20.—*Solidification time according to mould ramming-density for plates* 1-*in. and* 3-*in. thick,* (*a*) *in fine* (*H.*) *and* (*b*) *coarse* 14/28 *Redhill sands.*

intergranular radiation. Theoretical grounds[6] suggest that in a coarse-grain sand a larger amount of heat may be transferred by radiation; any such effect would result in an increase in the cooling power of the sand with an increase in grain size. This effect could be expected to be more pronounced at higher temperatures such as are encountered in steel castings, and may be of less importance at low temperatures, as with aluminium castings.

Effect of Moisture Content

The results presented in Figs. 18 and 19 show that in most instances the presence of moisture in the mould resulted in increased cooling power. This subject has been studied by several investigators[2 4 8] who concluded that the main effect of moisture in the mould is to cause a large increase in the rate of heat absorption shortly after pouring of the casting. This results from vaporization of water present in the sand adjacent to the interface and its subsequent condensation in the more remote parts of the mould; this migration of hot water, of course, results in a substantial transfer of heat outwards from the metal/mould interface. Later on during the solidification of the casting, most of the heat liberated by the casting is absorbed by that part of the mould which was dried in the early stages. Although further vaporization of water still occurs in the more remote parts of the mould and tends to increase the rate of heat transfer, the effect is now small and the rate of heat removal by the mould is at this stage little different from that of a dry-sand mould. Moisture films around the grains in that part of the mould where the temperature is below 100 deg. C. probably increase the apparent thermal conductivity in that region, but the effect of this on the cooling power may be a very minor one.

It will be observed that this explanation accounts for most of the effects observed in the present work, where it was found that in general the presence of moisture results in a decrease in freezing time of about 15 per cent. in the case of the soft-rammed moulds. The difference between "green" and dry-sand moulds appears to be less in the case of some of the hard-rammed moulds. Some decrease in this difference is perhaps to be expected, since the cooling power of hard-rammed moulds is substantially greater than that of soft-rammed moulds, so that the addition of water may have a relatively smaller effect in the hard than in soft-rammed moulds.

Because the effect of moisture is largely concentrated in the early stages of freezing, it is to be expected that the difference between the cooling power of "green" and dry sands would decrease with increase in the size of the casting. Some of the results presented in Fig. 20 are not conclusive on this point, but again the interplay of ramming density, moisture migration and grain and casting size may be such that no general theory can be applied.

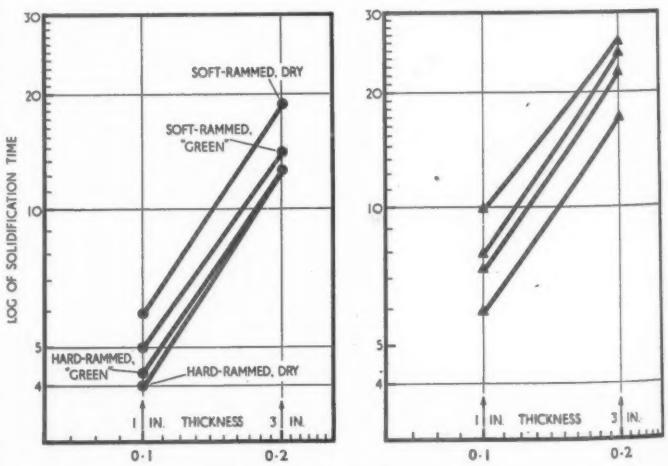


FIG. 21.—*Comparison of solidification times of block castings,* 1-*in. and* 3-*in. thick for different sand conditions, expressed logarithmically.*

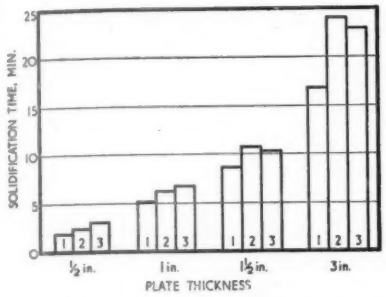


FIG. 22.—*Relation between casting section and cooling power of various moulds in Bromsgrove (B.2) medium sand:* (1) *black, green (B.2B);* (2) *black, dry (B.2B), and* (3) *red, dry (B.2).*

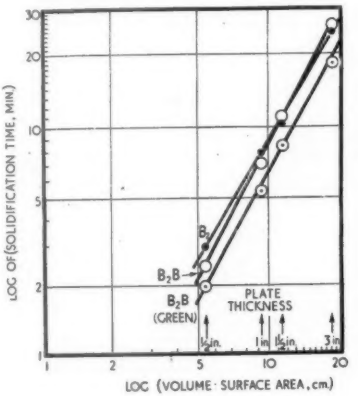
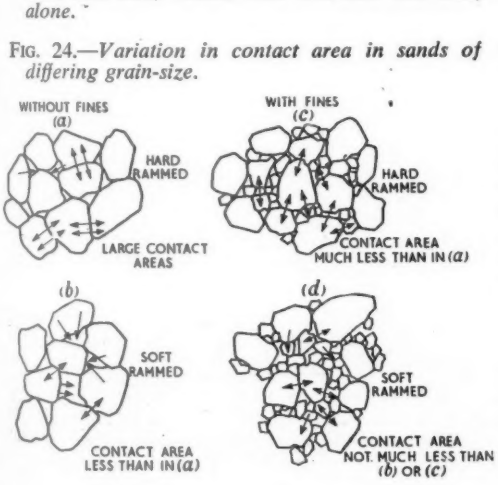


FIG. 23.—*Logarithmic interpretation of the results of experiments with plates of various thicknesses in Bromsgrove medium sands: B.2B. ("green"), with coal-dust; B.2B., with coal-dust and B.2., alone.*

FIG. 24.—*Variation in contact area in sands of differing grain-size.*



Effect of Raw Red Sand on Bosses to Prevent Drawing

It would appear from this investigation that the basic principle in using raw red sand is probably to act as a mild chill in the area in which it is used. Although some of the effects produced are conflicting, there would seem to be some justification for its use, for the following reasons:—

1. The absence of coal dust in the raw red sand reduces its cooling power.
2. The raw red sand would probably be more "open" (coarser) than the sand used in the rest of the mould. This would increase its cooling power.
3. Should the raw red sand be rammed harder than the rest of the mould it would increase its cooling power in that area, other conditions being equal.
4. Again, should the moisture content of the raw red sand be higher than the rest of the mould, that also would increase its cooling power in that area.

It would appear, therefore, that if the moisture content of the red sand is fairly high and it is an "open" sand, rammed hard, then it would have a local mild chilling effect. The raw red sand may also have an effect on the casting due to the rough surface obtained when it is used. This may affect the heat transfer through the mould/metal interface, but in which direction is not certain.

Apart from the question of black and red sand having effects on the heat flow, it is known in bronze founding that there is a different order of chemical reactivity with the metal poured. Thus it may well be that the moisture in red sands reacts with the metal and the gas absorbed contributes in preventing the "draw" in the adjacent sections.

(To be continued)

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[5] R. W. Ruddle, "Solidification of Castings," Institute of Metals Monograph No. 7, London, 1950.
[6] D. V. Atterton, *J.* Iron Steel Inst., 1953, **174**, 201.
[7] R. P. Dunphy and W. S. Pellini, *Trans.* Amer. Found. Soc., 1951 **59**, 425.
[8] H. F. Bishop, F. A. Brandt and W. S. Pellini, *Trans.* Amer. Found. Soc., 1951, **59**, 435.

Errata. Attention is drawn to the following corrections to the first section of this Paper printed in last week's issue: Page 291 (synopsis), line 17, should read . . . " in all but pure metals;" at the end of the same paragraph "flashes" should replace "splashes"; Fig. 1 caption should read "¼ to 2¼-in. plates," and in Fig. 2, the horizontal thermocouple on the right-hand side of the sketch should be extended into the casting.

Russian Pig-iron in Belgium

According to *Echo de la Bourse*, deliveries of Russian pig-iron to Belgium have evoked another protest to the High Authority of the European Coal and Steel Community by French pig-iron producers, who point out the "serious consequences" of such imports on the French pig-iron industry, as their capacity is still not fully utilized.

Imports and Exports of Iron and Steel in July

The following tables, based on Board of Trade returns, gives figures of imports and exports of iron and steel in July. Totals for the first seven months of this year and last are also included.

Exports of Iron and Steel

Destination.	Month ended July 31.	Seven months ended July 31.	
	1955.	1954.	1955.
	Tons.	Tons.	Tons.
Channel Islands	401	2,566	3,554
Cyprus	440	4,128	2,793
Sierra Leone	611	7,177	5,117
Gold Coast	1,368	21,569	13,755
Nigeria	4,428	35,071	27,991
Union of South Africa	2,227	24,211	40,641
Rhodesia and Nyasaland	3,979	35,219	38,578
Tanganyika	1,398	12,311	8,724
Kenya	1,842	42,323	28,573
Uganda	418	3,450	2,454
Mauritius	138	3,797	1,364
Bahrain, Qatar and Trucial Oman	495	14,083	7,060
Kuwait	87	3,836	1,808
India	3,884	55,708	65,452
Pakistan	1,504	33,092	24,520
Singapore	2,105	15,437	20,438
Malaya	1,682	15,003	11,319
Ceylon	284	11,392	9,580
British North Borneo	701	2,186	2,650
Hongkong	2,132	13,481	26,673
Australia	26,387	154,319	227,633
New Zealand	17,733	117,556	151,973
Canada	7,545	113,981	62,755
Jamaica	470	8,526	7,003
Trinidad	3,066	23,812	27,539
British Guiana	404	3,603	3,803
Anglo-Egyptian Sudan	13	21,294	9,355
Other Commonwealth countries	1,524	13,823	17,890
Eire	4,767	28,926	33,744
Finland	5,140	37,836	42,197
Sweden	12,782	42,164	79,069
Norway	9,593	45,546	72,235
Denmark	6,372	53,160	48,232
Western Germany	519	4,292	4,798
Netherlands	5,781	59,156	56,196
Belgium	2,164	6,553	13,133
France	375	2,946	3,398
Switzerland	777	6,433	8,982
Portugal	1,157	7,040	7,892
Spain	5,647	4,494	46,103
Italy	2,719	26,659	16,833
Austria	177	828	1,713
Yugoslavia	716	8,620	9,985
Turkey	302	6,982	6,381
Netherlands Antilles	78	2,232	6,622
Portuguese E. Africa	291	1,656	1,097
Lebanon	4,058	1,193	9,140
Israel	567	5,398	5,845
Egypt	523	18,028	14,801
Saudi Arabia	289	1,444	4,455
Iraq	946	19,149	25,206
Iran	181	4,015	28,436
Burma	501	6,807	7,669
Thailand	157	4,300	2,992
Indonesia	529	3,699	2,337
Philippine Republic	212	2,110	3,056
USA	5,036	21,354	26,233
Colombia	201	5,528	3,673
Venezuela	4,127	22,740	31,983
Ecuador	96	1,863	1,381
Peru	162	3,481	4,925
Chile	2	816	599
Uruguay	1,243	9,374	4,803
Argentina	7,283	40,245	36,786
Other foreign countries	4,794	44,860	29,698
TOTAL	177,530	1,374,881	1,553,623

Total Imports of Iron and Steel

From	Month ended July 31.	Seven months ended July 31.	
	1955.	1954.	1955.
	Tons.	Tons.	Tons.
Australia	9	20,200	59
Canada	5,669	5,860	65,942
Other Commonwealth countries and Eire	9,909	4,098	17,546
Soviet Union	14,369	97,535	109,811
Sweden	2,899	26,523	17,426
Norway	7,840	17,991	42,528
Western Germany	5,426	40,306	19,871
Netherlands	18,817	60,098	89,004
Belgium	9,829	26,347	69,852
Luxembourg	3,479	11,098	18,931
France	18,333	42,908	107,191
Italy	503	7,497	769
Austria	968	117,746	70,037
Japan	9,244	55	17,277
USA	81,395	38,955	437,848
Other foreign countries	1,482	2,437	6,865
TOTAL	190,171	519,654	1,090,957
Iron and steel scrap and waste, fit only for the recovery of metal	106,314	456,680	732,722

Exports of Iron and Steel by Products

Product.	Month ended July 31.	Seven months ended July 31.	
	1955.	1954.	1955.
	Tons.	Tons.	Tons.
Pig-iron	4,755	12,685	33,029
Ferro-columbium (niobium)*	—	—	44
Ferro-tungsten	58	332	282
Other ferro-alloys†	266	5,126	1,703
Ingots, blooms, billets, slabs, sheet, and tinplate bars	257	1,354	3,301
Iron bars, rods, angles, shapes, and sections	173	1,577	2,118
Steel bars, rods, angles, sections, and shapes	25,468	196,536	243,480
Iron plates and sheets	1	313	99
Universal plates	1,095	3,083	6,103
Steel plates, ¼ in. and under ⅛ in.	1,453	7,870	13,051
Do., ⅛ in. and over	18,152	88,782	160,532
Black sheets and black plate	16,677	119,318	127,207
Hoop and strip	9,029	63,041	62,799
Tin plate	29,229	181,098	180,015
Tinned sheets, terneplate, and ternesheets	345	1,299	1,707
Decorated tinplate	172	1,693	2,460
Galvanized sheets	13,651	99,050	95,546
Other coated plates and sheets	706	5,168	7,066
Railway and tramway construction material	10,320	141,383	145,800
Wire rods	1,545	18,357	17,091
Wire	6,270	50,619	56,680
Tubes, pipes, and fittings	37,323	363,502	384,851
Iron castings	105	8,124	4,890
Steel castings	117	1,912	1,173
Forgings	363	2,659	1,996
TOTAL	117,530	1,374,881	1,553,623

* Not separately distinguished before 1955.
† The figures for 1955 are not completely comparable with those for previous years.

THE AUSTRALIA (VICTORIA) BRANCH of the Institute of British Foundrymen at their July meeting, held in the Melbourne Technical College, heard a paper from Mr. G. D. A. Nash and Mr. A. W. Silvester entitled "A Campaign for Lining a Detroit-type Electric Furnace."

IN ITS THIRD YEAR, the International Handicrafts, Homecrafts & Hobbies exhibition, to be held at Earls Court, London, from September 22 to October 1, has more than doubled in size.

News in Brief

LAMBERT BROS., LIMITED, of Green Lane, Walsall, are to build an extension to their existing foundry at an estimated cost of £1,000.

SOUTHERN FOUNDRIES (1926), LIMITED, Purley Way, Croydon, Surrey, are having new offices and baths erected at a cost of £30,000.

THE DERBY TECHNICAL COLLEGE, which begins its 65th session this month, will, in future, be known as the Derby and District College of Technology.

SUMMERSON'S FOUNDRIES, LIMITED, have had plans approved for the reconstruction of the inspection shop at Albert Hill Foundry, York Street, Darlington.

BRITISH THOMSON-HOUSTON COMPANY, LIMITED, Rugby, have received an order valued at £750,000 from the New Zealand Government, for five steam turbo-alternator sets.

AT THE WORKS of Briggs Motor Bodies, Limited, Doncaster, some 2,000 workpeople will be employed on day and night shifts, in the production of Ford cars, by next month.

ARRANGEMENTS are in hand for an industrial and economic survey of the Tees-side area under the auspices of the North-East Industrial Development Association. The work will take three years.

ACCORDING to the *Purchasing Bulletin*, the organ of the Purchasing Officers Association, the price of iron castings has risen by 3½ to 7½ per cent. since the recent increases in the prices of fuel, etc.

A NEW products development department has been created by James A. Jobling & Company, Limited, makers of scientific glassware, etc., of Sunderland, under the managership of Mr. P. L. Kirby.

THE FIRST MEETING of the autumn series of the Non-Ferrous Club was held at the Queen's Hotel, Birmingham, on September 8. The guest speaker was Mr. W. S. Bennett, who spoke on "How to Make an After-dinner Speech."

ELKINGTON & COMPANY, LIMITED, Goscote Lane, Bloxwich, have had plans approved for the rehousing of the machine shop, a new steel and die storehouse, and the extension of the hot brass stamping department. The estimated cost is about £25,000.

TUBE INVESTMENTS, LIMITED, announce, in conjunction with Murugappa & Sons, of Madras, the formation of a new company, Tube Products of India, Limited, for the manufacture, fabrication and manipulation of electric resistance welded steel tubes.

STEEL, PEECH AND TOZER, LIMITED, Rotherham, branch of the United Steel Companies, Limited, have brought into use the furnace-scanning periscope developed by the Battersea laboratories of the British Iron and Steel Research Association.

CAPTAIN J. F. STANIER, chairman and managing director of the Renishaw Iron Company, Limited, near Sheffield, opened a flower-show and gala day at the Eckington Miners' Welfare ground on September 10, in aid of the Eckington Elderly Friendship Club building fund.

AFTER A LONG SEARCH for a suitable site, the British Oxygen Company, Limited, are now on the point of concluding negotiations with Colvilles Limited, for factory space at Ravenscraig, Motherwell. Two sites, surplus to the steel firm's requirements, have been offered.

MR. G. B. REILLY, of the biology laboratory of Newton Chambers and Company, Limited, engineers, Thorncliffe Works, Chapeltown, Sheffield, has set workmates in the firm an unusual task. He has asked them to collect grass snakes, alive and unharmed for him to examine.

SOME 120 WORKERS of Spencer & Halstead, Limited, engineers, Ossett, Yorkshire, visited the foundry exhibition at Olympia on September 10, as guests of the management. They saw some of the fan engineering and dust-extraction plant they had built in their own workshops.

Mr. N. L. GOODCHILD, managing director of Cowlishaw, Walker & Company (London), Limited, is in America visiting press shops in Chicago and Detroit to examine the latest automatic transfer technique as applied to power presses. It is hoped to adapt some of these devices for use in this country.

AGREEMENT has been reached between Mr. Norton, Eire Minister for Industry and Canadian mining interests, on the development of the copper mines at Avoca, Co. Wicklow. The terms of the agreement cover the development and exploration of about 36,000,000 tons of copper-ore and exploration for other minerals.

AMONG THE RANGE of scientific instruments to be shown by Kelvin Hughes, Limited, at the Minibition of the Purchasing Officers' Association, at Cliftonville, September 29 to October 1, will be instrument motors, barometric capsules, sine/cosine potentiometers, capsule-operated potentiometers, teletorque synchro units, magnetic recording heads and optical ware.

THE BOARD OF TRADE announce the issue of an open general licence authorizing the export to any destination other than China, Macao, North Viet Nam or Tibet, of specified brands of refined pig lead. This licence came into operation on September 14. Copies are obtainable from HM Stationery Office, Kingsway, London, W.C.2, and branches, price 2d. (by post 3½d.).

ANOTHER £1 MILLION CONTRACT has been added to the Clyde's shipbuilding order book. British Railways have ordered a new car-ferry for the Dover-Boulogne service from William Denny & Bros., Limited, Dumbarton. The vessel will be similar in design to the Lord Warden built at the same shipyard in 1952. It will replace the Dinard and will have accommodation for 1,000 passengers and 130 cars.

ARRIVALS of iron and steel scrap at the rate of almost 14,000 tons a month are said by the River Wear Commissioners to be responsible for a substantial rise in imports into the river. In the first seven months of this year imports into the Wear totalled 317,131 tons, an increase of 127,501 tons compared with the same period last year. Inward cargoes of iron and steel scrap amounted to 96,448 tons, and iron and steel imports to 21,074 tons.

BIG DEPOSITS of bauxite have been discovered on the mainland of French Guinea by the *Société Africaine de Recherches et d'Etudes pour l'Aluminium*. SAREPA, which is partly owned by the French Government and partly by Péchiney & Ugine, the French aluminium producers, is interested in aluminium production in French Guinea, and has for three years been investigating the possibilities. These investigations are stated to be virtually complete.

UNEMPLOYMENT in Scotland is more than four times that of London and the South-Eastern Region and about five times greater than the percentage for the Midlands. According to the Ministry of Labour, Birmingham has 2,396 unemployed, Manchester 2,919, and Liverpool 9,416, whereas Glasgow has 13,086—almost as many as in the whole of Wales. In the steel towns of Motherwell and Middlesbrough the figures showed 1,859 in the former and 772 in the latter.

News in Brief

NO MATERIAL CHANGE in freight values is reported from the Mediterranean to the United Kingdom, and once again ore from Bona to Tyne or Middlesbrough has been fixed for 9,500 tons at 36s. 6d. for second half October. A similar rate has been accepted by a 9,000-tonner to Cardiff, direct, for October 5-31. Demand is still good from the North African ports, and tonnage is also required from the Western Mediterranean, but, at the moment, it is inclined to be scarce.

WILLIAM JESSOP AND SONS, LIMITED, steelmakers, have produced at their Portland Street works, Sheffield, a mould for the production of furnace bricks, which is lined with tungsten-carbide plates. This has produced a revolution in the production of the bricks as steel-lined moulds had previously to be frequently reconditioned, sometimes at the end of each shift. Now a pair of these moulds has produced well over 10,000,000 bricks, which would have been impossible with previous moulds.

THE ASSEMBLY of David Brown tractors is being planned in South Africa where a new company for the purpose has been established with headquarters at East London, Cape Province, and factory accommodation is being secured. In the early stages wheeled tractors will be despatched from the Meltham, Huddersfield, factory, and assembled in South Africa. The importing and servicing of all David Brown agricultural equipment in the Union will also be carried out by the new company.

THE APPROACH of the Beaver Committee to the nuisance from smoke and dust arising from industrial furnaces, as opposed to boilers, is timid and nullifies progressive aspects of the recommendations, according to the annual report of the Sheffield, Rotherham and District Smoke Abatement Committee. Emphasizing the "virtual exemption or considerable protection" given to metallurgical processes, the report says that these processes can be carried out smokelessly or with a minimum and defined standard of smoke emission.

CHAMBERLAIN INDUSTRIES, of Staffa Works, Leyton, London, E.10, have recently augmented their line of "Staffa" tube bending machinery by the introduction of a new series of hydraulic draw bending machines. A complete range of 7 machines is available for the bending of tubes of diameters up to 12 in. to small radii. They announce the appointment of Drummond-Asquith (Sales), Limited, of King Edward House, New Street, Birmingham, 2, as sole distributors of these machines in this country and overseas.

THE DARLASTON ENGINEERING SHOPS of the Wellman Smith Owen Engineering Corporation continue to be engaged to capacity, reports Mr. Peter G. Roberts, chairman of the corporation, in his annual review. The Corporation has played an important part in the production of plant for the expansion of the British steel industry, and increasing world demand for capital equipment, particularly for the metallurgical industries, holds favourable prospects for the group. A technical panel to direct research and study improved methods of production and design has been instituted by the group.

THE INSTITUTION OF MECHANICAL ENGINEERS are arranging a conference on lubrication and wear to be held in London from Monday to Wednesday, October 1 to 3, 1957. Meetings for the presentation of papers will be held each day, as much time as possible being allowed for discussion. It is hoped to obtain papers covering the whole field of lubrication and wear; these will be grouped, and offers of papers from members and non-members are invited. Details are available from the secretary of the Institution, 1, Birdcage Walk, Westminster, London, S.W.1.

SIR ROY WELENSKY, Deputy Prime Minister of the Federation of Rhodesia and Nyasaland, visited the Metropolitan-Cammell Wagon and Carriage Company, in Birmingham, on September 9. One of the strongest impressions left with him, he said, was the thriving pace of production and the speed and efficiency of the workpeople. He announced that Rhodesia, which has already bought 3,700 railway vehicles from Metropolitan-Cammell since 1948, has just placed an order with the firm for another 450 high-sided bogie-wagons worth £2,000 each. Rhodesia, he said, had embarked on a tremendous expansion programme.

THE Society of Industrial Radiology and Allied Methods of Non-destructive Testing commences its winter programme during October, and monthly meetings have been arranged by the branches at London, Birmingham, Sheffield and Glasgow. The Society, which was founded at the close of last year, and now has a membership of over 200, is the first professional body, in this country, endeavouring to co-ordinate all specialists employed in the various methods of non-destructive testing. Details of the Society's activities are obtainable from the hon. secretary, Mr. D. N. Laurie, 2, Tomswood Terrace, Barkingside, Essex.

AMONG THE EXHIBITS by West's Gas Improvement Company, Limited, at the forthcoming Fuel Efficiency Exhibition, October 12 to 22, will be the Flämrich resonance screen. It is giving good results in many parts of the Continent, but has so far not been seen in this country. As licensees of the screen in the United Kingdom, the company is taking the opportunity of introducing it to the fuel industries. Primarily developed for high-capacity screening of coal and coke, the Flämrich resonance screen has a wide range of applications in the grading of bulk materials and is suitable for duties from coarse scalping to fine sizing and de-watering.

THE CENTRAL ELECTRICITY AUTHORITY has announced the agreement to supply steam from the Spondon power-station, near Derby, to the Spondon factory of British Celanese, Limited. The use of this steam which normally goes to waste after being used to generate electricity is estimated to result in the saving of 10,000 tons of coal a year. By the arrangement British Celanese becomes the recipient of "by far the largest public supply of steam to industry in the country." The British Celanese works at Spondon stand on a site adjoining the power-station and this enables only a short delivery system to be used in feeding the waste steam and makes its use economic.

THE BUTTERLEY COMPANY, LIMITED, announce they have secured a further contract for a large oxygen/nitrogen plant to be installed at the Billingham Division of Imperial Chemical Industries, Limited. This plant will produce 240 tons of high-purity oxygen and 400 tons of very-high-purity nitrogen daily. In addition to the above, contracts already in hand include a 200-ton-per-day very-high-purity oxygen plant for Stewarts and Lloyds, Limited, for their Corby works. Contracts for smaller plants have also been secured from the Newport Division of the Steel Company of Wales, Limited, and British Celanese, Limited. Orders secured to date for various types of oxygen/nitrogen plants are now valued at considerably more than one million pounds.

New Patents

(Copies of complete specifications are obtainable from the Patent Office Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3/-.)

736,138. Aktiebolaget Westin & Backlund, Liljeholmsvagen 8, Stockholm, 9, Sweden.

A moulding machine which comprises in combination two squeezing and pattern-parting units, and a shaft carrying these units, each of which have a mould table. A squeezing plate is so arranged so that the two mould tables and the two squeezing plates are diametrically opposite one another. The pattern-parting units are designed to rotate around an axis located between the units so as to change their relative positions. It is claimed that this machine will mount a mould flask, fill it with sand, and squeeze, while at the same time the pattern is parted, and the removal of the finished mould is effected at the other unit.

736,315. Allied Ironfounders, Limited, 28, Brook Street, London, W.1.

A new or improved method for the filling of sand or other material in coreboxes, moulds or dies. A gaseous medium such as air under pressure, is passed through tubes ending in the neighbourhood of a magazine outlet, through which the sand also passes.

736,401. J. B. Brennan, 13018, Lake Shore Boulevard, Cleveland, Ohio.

A method of continuously casting. A part of the die passage is inductively heated, while another part is cooled. The metal is fed through the passage, where it is subsequently heated and cooled, over separate parts of its periphery. This is claimed to eliminate "sticking" in the die.

Company News

LEY'S FOUNDRIES & ENGINEERING, LIMITED—A quotation is being sought for 550,000 6 per cent. £1 cumulative preference shares, which have been issued by way of capitalization of reserves.

ENGLISH STEEL CORPORATION, LIMITED—An interim dividend of 3 per cent. has been declared on the £8,000,000 ordinary capital, composed of £6,000,000 in "A" shares and £2,000,000 in "B" shares. The "A" shares are held by Vickers, Limited, and the "B" shares by Cammell Laird & Company, Limited.

A. E. GRIFFITHS (SMETHWICK), LIMITED—The company has acquired the entire capital of Modern Furnaces & Stoves, Limited, Birmingham. The purchase has been financed out of the company's own resources. Mrs. F. Newstead has resigned as a director of Modern Furnaces & Stoves, while Mr. J. L. Goodwill, Mr. T. C. Sharpe, Mr. R. Wright, and Mr. R. T. Price have been appointed additional directors.

DOUGLAS (KINGSWOOD), LIMITED, engineers, etc., of Bristol—The offer by the Westinghouse Brake & Signal Company, Limited for the debenture, ordinary, and deferred capital of the company is now formally made to holders. The terms are recommended by the directors of Douglas (Kingswood), who intend to accept for themselves. The offers, they say, fully reflect the value of Douglas capital even assuming continued trading at the profit levels likely during some further years of current conditions. Westinghouse, it is stated, has indicated that it will seek to retain the services of Mr. C. McCormack in the capacity of managing director and of Mr. C. C. Vinson as a director. The remaining directors will resign on completion of the transaction without compensation.

THE NATIONAL FOUNDRY CRAFT TRAINING CENTRE

There are vacancies on the four week course commencing Monday, 3rd October, for boys who have not attended the Centre before. Foundries wishing to nominate apprentices should communicate at once with the Hon. Secretary of the Centre,

NORWICH UNION CHAMBERS, CONGREVE STREET, BIRMINGHAM, 3

(Telephone: Central 4391)

Residential Club for Students:
Lawnside,
25, Beeches' Road,
West Bromwich.

Training Centre:
at Rudge Littley Ltd.,
Phoenix Street,
Swan Village,
West Bromwich.

Personal

Mr. R. E. G. WEDDELL, joint managing director of W. G. Allen and Sons, of Tipton, has been elected president of the Institute of Welding for 1955-56.

P.I. CASTINGS (ALTRINCHAM), LIMITED, manufacturers of investment castings, announce the appointment of Mr. P. G. CHAPMAN as technical representative for the Southern Counties.

ALDERMAN FRANK MANSELL, Mayor of Wolverhampton, opened a pair of wrought-iron gates at Guy Motors' recreation ground on September 14, to commemorate the firm's 40th anniversary.

Mr. L. G. EARLE, B.SC., A.R.S.M., F.I.M., M.I.M.M., until recently refineries manager of Capper Pass & Son's Melton works, has joined Campbell, Gifford & Morton, Limited, of Weybridge, as a director.

Mr. T. E. WILSON has been appointed assistant (electric traction and generation) to the chief mechanical and electrical engineer British Railways, London Midland Region, Derby. He was formerly assistant electric traction engineer at Manchester.

MR. ALAN THOMAS, group internal auditor with the Davy and United Engineering Company, Limited, has been appointed assistant secretary of the Sheffield branch. He has been with the firm since 1946, joining them after serving with the Royal Signals 1940 to 1946, in Africa, Italy and Austria.

SIR PERCY H. MILLS, the first president of the Institute of Industrial Supervisors, who played so prominent a part in the Institute's foundation in 1948, is to go to America this month to receive the Edward O. Seits memorial award for international management, presented by the National Association of Foremen of America.

THE VACANCY in the managership of the technical services department of the Nobel division of Imperial Chemical Industries, Limited, caused by the retirement of Mr. JOHN HANCOCK, has been filled by Dr. ROBERT WESTWATER, a mining engineer and an authority on large-scale blasting. He has been an assistant manager of the department since 1948.

Mr. W. M. LARKE, general manager of the Bilston works of Stewarts and Lloyds, Limited, is in Australia to take part in the opening of a new steelworks at Broken Hill for the tube manufacturers of the Commonwealth. His visit follows the virtual completion of a £3,000,000 expansion scheme designed to increase substantially the output of the Bilston plant.

THE APPOINTMENT is announced of Mr. R. H. COLLCUTT as head of the operational research section of the British Iron and Steel Research Association. Mr. Collcutt, who succeeds Mr. R. T. EDDISON in that position, was educated at the Cathedral School, Truro, and University College, London. Specializing in mechanical and civil engineering, he took his B.Sc. (Eng.) degree with honours.

THE DIRECTORS of Birmid Industries, Limited, announce three new appointments to the board, namely:—Mr. J. W. BERRY, joint managing director, Birmingham Aluminium Casting (1903) Company, Limited; Mr. H. GOODWIN, joint managing director, Birmetals, Limited; and Mr. G. A. RIDER, commercial director, Birmingham Aluminium Casting (1903) Company, Limited.

Mr. S. W. T. MITCHELMORE, United Kingdom Trade Commissioner at Vancouver, leaves Canada on October 28. He will be succeeded in Vancouver by Mr. P. B. HUNT, formerly a United Kingdom Trade Commissioner at Montreal. Mr. D. M. J. GWINNELL, at present serving in engineering industries division of the Board of Trade, is being appointed Trade Commissioner, grade II, at Montreal, in succession to Mr. Hunt.

G. & J. WEIR, LIMITED, Glasgow engineers, announce the appointment of Dr. A. M. BAXTER, M.Sc., as head of their research department, to take effect from December 1. Dr. Baxter, who is at present the senior lecturer in the department of civil and mechanical engineering, Royal Technical College, Glasgow, served his apprenticeship at Weirs and was awarded the Parsons scholarship by the Institution of Naval Architects, graduating B.Sc. with honours in 1936. He was also awarded the A.R.T.C. and Montgomerie Neilsen prize for a thesis on the recording of torsional oscillations. Dr. Baxter entered Emmanuel College, Cambridge, in 1937; he carried out research in yield point phenomena in steels and was awarded the M.Sc.

Mr. SYDNEY WEINBERG, head of the research department of G. & J. Weir, Limited, engineers, Glasgow, is giving up the post shortly to take over an appointment in London as deputy chief engineer (technical) of the National Coal Board. He comes from Manchester and has had wide experience as university lecturer and practising engineer before joining the Glasgow firm ten years ago. It was when he was with a Birmingham engineering firm that he began his experiments on the combustion system of the jet engine, as a member of the panel that worked with Sir Frank Whittle. Two years ago he won the prize of the Institution of Mechanical Engineers for a paper on heat transfer. He still lectures on scientific and engineering subjects.

Obituary

THE death is announced of Mr. ROBERT E. KENNEDY, who for many years was secretary of the American Foundrymen's Society. He visited England during one of the early international congresses, and was extremely well liked by everybody with whom he came in contact. He was 67 years old and had not enjoyed good health in recent years, but continued fairly actively in his retirement.

THE DEATH OCCURRED on September 12 of Mr. FREDERICK CHARLES BUSH, at the age of 86. He was a former director and general manager of the Raleigh Cycle Company, Limited, and had been associated with the firm for more than 46 years. After his retirement from the company, he joined the board of directors of Castle Engineering Company, Limited, Nottingham, and was chairman at the time of his death.

THE DEATH IS ANNOUNCED, at the age of 81, of Mr. H. James YATES, founder and first chairman of Radiation Limited. He was the inventor of the gas cooker with removable burners, which appeared on the market in 1894, a year after he had bought the business of Arden Hill & Company, Limited. Later, an association with the Eagle Range & Foundry Company, Limited, was formed, the company being bought up, in 1900, by John Wright & Company, Limited. In 1908, Mr. Yates became chairman of the group. The formation of Radiation Limited, in 1919, was the result of his conviction that closer association would benefit the leading gas-appliance manufacturers and one of his first measures was to equip the group with first-class research facilities. Mr. Yates was a member of the first Gas Heating Research Committee, and a founder member of the Federation of British Industries and the International Chamber of Commerce.

FIRST WITH W20

BEETLE RESIN* W42

This new synthetic resin core-binder has been specially developed to suit those foundries where fumes and casting odours cause embarrassment. The result of practical co-operation between B.I.P. and leading foundries, Beetle W42 is another example of B.I.P.'s pioneer research and service to the Foundry Industry. W42 has been formulated with the Garrett Report in mind and it possesses all the advantages of Beetle Resin W20, coupled with this important new feature . . .

reduced casting odour

* Patent Application 32896/58

B·I·P

Write for technical information to B.I.P. Chemicals Limited, Tat Bank House, Oldbury, Nr. Birmingham

London Office: 1 Argyll Street, W.1. *'Beetle' is a trade mark registered in Great Britain and in most countries of the world.*

Raw Material Markets

Iron and Steel

There are now 96 furnaces in blast, compared with 102 at this time last year, but outputs of pig-iron have not suffered proportionately, as new and larger furnaces have taken the place of some old and obsolete units. In part, of course, the reduction in the number of units is caused by furnaces taken out of blast for relining and repairs. Present outputs are at a high level.

Foundries utilizing hematite and low- and medium-phosphorus irons are inundated with orders and experience great difficulty in securing the pig-iron they require. They have suffered considerably by the closing down for relining and repairs of one of the biggest furnaces producing low-phosphorus iron, and there is no immediate prospect of additional supplies of this grade becoming available. Continental foundry pig-iron and hematite have advanced considerably in price during the last few weeks and the difference between the figures quoted and the home prices form too wide a gap to be bridged.

The position at the light foundries is in a state of flux. As stocks of castings are reduced, particularly at foundries working for the domestic utensil and building trades, demands should improve and there are some signs that business is picking up for these establishments. Most of the jobbing foundries are busy and are taking up good tonnages of high-phosphorus pig-iron. Outputs of this grade appear to be equal to present demands, apart from the higher silicon irons—of 4 per cent. silicon content and over—which are rarely produced.

The demand for scrap is maintained, and is strong in the case of heavy cast-iron and machinery scrap. Sufficient foundry coke is coming forward to satisfy current consumption requirements, although at many foundries stocks are low.

Most of the steel mills are fully booked to the end of the year and they are reluctant to accept tonnage for 1956 delivery until they have cleared some of the arrears.

Non-ferrous Metals

The London copper market has been rather uneasy. Wide price fluctuations have occurred pending an answer to the petition to the President from the United States copper and brass using industries for the release of 100,000 tons from the stockpile. Confidence in its success waned following the diversion last week of an additional 11,000 tons earmarked for the stockpile. Other considerations contributing to the sensibility of the current market have been the more optimistic view taken by some Continental countries about the future course of the copper price and the fact that consumers are adopting a hand-to-mouth purchasing policy to cover only their immediate requirements.

In any event, offerings are being quickly absorbed; wire bars were sold last week to Continental consumers for October and November delivery at £410 per ton and it is thought that a large proportion of the copper stocks in UK warehouses is earmarked for consumption or export. In the US supplies are still tight, but, with domestic production getting back into its stride, consumers are less inclined to pay premium prices.

Demand for tin at the beginning of the week was quite steady, but the Eastern Smelting Workers' Union's strike threat imparted a firmer tone to the tin markets here and in New York. Virgin tin consumption in the UK during July totalled 1,615 tons compared with 1,997 tons in June.

Demand for lead and for zinc on both sides of the Atlantic this week has been little more than moderate. US producers seem to be pleased with the present lead price of 15 cents a pound and little has been heard lately of the price going higher. Zinc appears to be in a similar position and at least one prominent US manufacturer has forecast that there will be little or no change in the price of zinc in the next few months and possibly throughout 1956.

Official metal prices were as follow:—

COPPER, Standard—*Cash*: September 15, £382 to £382 10s.; September 16, £379 to £380; September 19, £374 to £374 10s.; September 20, £376 to £377; September 21, £379 to £380.

Three Months: September 15, £377 10s. to £378; September 16, £374 to £375; September 19, £370 to £371 10s.; September 20, £374 to £375; September 21, £376 to £376 10s.

TIN, Standard—*Cash*: September 15, £747 10s. to £748; September 16, £750 to £750 10s.; September 19, £751 to £751 10s.; September 20, £754 to £755; September 21, £757 10s. to £758 10s.

Three Months: September 15, £748 to £748 10s.; September 16, £751 to £751 10s.; September 19, £751 10s. to £752; September 20, £755 to £756; September 21, £757 10s. to £758 10s.

LEAD—*First half September*: September 15, £107 10s. to £107 15s. *Second half September*: September 16, £107 5s. to £107 15s.; September 19, £107 5s. to £107 7s. 6d.; September 20, £106 10s. to £106 15s.; September 21, £106 15s. to £107.

First half December: September 15, £107 5s. to £107 10s. *Second half December*: September 16, £107 to £107 10s.; September 19, £106 15s. to £107; September 20, £106 5s. to £106 10s.; September 21, £106 10s. to £107.

ZINC—*First half September*: September 15, £92 5s. to £92 10s. *Second half September*: September 16, £92 to £92 5s.; September 19, £91 15s. to £92; September 20, £91 5s. to £91 10s.; September 21, £92 to £92 5s.

First half December: September 15, £91 15s. to £92. *Second half December*: September 16, £91 15s. to £92; September 19, £91 5s. to £91 10s.; September 20, £91 to £91 5s.; September 21, £91 15s. to £92.

Merseyside Foundry Course

The Merseyside District Advisory Council for Further Education announce that amongst courses of advanced lectures in engineering at the St. Helens Technical College are lectures in foundry practice. The fee for the course, commencing October 26, is £1, and the following is an outline of the programme:—(1) "Core and Core-making Materials," by A. Tipper M.SC., F.I.M. (Wednesday, October 26); (2) "Foundry Practice—CO_2 Process," by A. Talbot (Friday, November 4); (3) "New Methods for Old," by F. Hudson, F.I.M. (Wednesday, November 9); (4) "Effect of Mould Materials on the Solidification Rate of Cast Metals," by J. Hird (Wednesday, November 16); (5) "Exothermic Materials in the Feeding of Castings," by D. H. Snelson (Wednesday, November 23); (6) "Foundry Sands," by R. G. Godding (Wednesday, November 30); and (7) "Shell Moulding," by D. A. Taylor (Wednesday, December 7). Each session lasts two hours, from 7 to 9 p.m. Enrolment applications should be forwarded to the Principal, St. Helens Technical College, Victoria Square, St. Helens, as early as possible.

SUPINEX "R" IN USE—

Illustration of Binnacle casting in DTD 165 alloy by courtesy of Gascoignes Non-Ferrous Foundries Ltd., Slough.

SUPINEX "R"
CORE BINDER

AN ENTIRELY NEW TYPE OF BINDER, STARTLING IN ITS PERFORMANCE . . .

- ★ **EXCEPTIONAL "KNOCK-OUT" PROPERTIES**
- ★ **FUMES AND GASES GREATLY REDUCED**
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Current Prices of Iron, Steel, and Non-ferrous Metals

(*Delivered unless otherwise stated*)

September 21, 1955

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £17 1s. 0d.; Birmingham, £16 13s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £18 12s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £19 8s. 3d.

Scotch Iron.—No. 3 foundry, £19 5s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £21 3s. 0d.; South Zone, £21 5s. 0d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £22 0s. 0d.; South Zone, £22 3s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent. :—N.-E. of England (local iron), £19 5s.; Scotland (Scotch iron), £19 11s. 6d.; Sheffield, £20 12s. 0d.; Birmingham, £20 19s. 6d.; Wales (Welsh iron), £19 11s. 6d.

Basic Pig-iron.—£16 16s. 6d. all districts.

FERRO-ALLOYS

(*Per ton unless otherwise stated, delivered*)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £40 15s. 0d., scale 15s. per unit; 75 per cent. Si, £63 0s. 0d., scale 16s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 11s. 0d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £230 0s. 0d.; 38/40 per cent., £279 0s. 0d.

Ferro-tungsten.—80/85 per cent., 18s. 7d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 21s. 7d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent. C, £83 0s. 0d. to £86 0s. 0d., basis 60 per cent. Cr, scale 25s. 0d. per unit; over 6 per cent. C, £81 0s. 0d. to £84 0s. 0d., basis 60 per cent. Cr, scale 24s. 0d. per unit; 2 per cent. C* 1s. 11½d. per lb. Cr.; 1 per cent. C,* 2s. 0d. per lb. Cr; 0.15 per cent. C,* 1s. 11d. to 2s. 1d. per lb. Cr; 0.10 per cent. C,* 1s. 11d. to 2s. 2d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 0d. to 7s. 6d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £249 0s. 0d.; 96/98 per cent., £269 0s. 0d.

Ferro-columbium.—60/75 per cent., Nb + Ta, 37s. per lb., Nb. + Ta.

Ferro-manganese (home).—78 per cent., £54 10s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £26 19s. 0d.; tested, 0.08 to 0.25 per cent. C, £27 19s. 0d.; hard (0.41 to 0.60 per cent. C), £29 5s. 6d.; silico-manganese, £36 7s. 6d.; free-cutting, £31 0s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £34 12s. 0d.; silico-manganese, £36 7s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £31 11s. 0d.; basic, hard, over 0.41 up to 0.60 per cent., C, £32 13s. 6d.; acid, up to 0.25 per cent. C, £35 12s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £33 1s. 6d.; boiler plates (N.-E. Coast), £35 11s. 6d.; floor plates (N.-E. Coast), £34 10s. 6d.; sectional material, N.-E. Coast, £30 19s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £33 19s. 6d.; flats, 5 in. wide and under, £33 19s. 6d.; hoop and strip, £35 1s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £36 5s. 0d.; black sheets (hand mill), 17/20 g., £46 13s. 6d.; galvanized corrugated sheets, 24 g., £58 11s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £58 0s. 3d.; nickel-chrome, £81 10s. 0d.; nickel-chrome-molybdenum, £92 7s. 6d.

NON-FERROUS METALS

Copper.—Cash, £379 0s. 0d. to £380 0s. 0d.; three months, £376 0s. 0d. to £376 10s. 0d.; settlement, £380 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 3s. 7⅝d. per lb.; rods, 417s. 9d. per cwt. basis; 20 s.w.g., 441s. 0d. per cwt.

Tin.—Cash, £757 10s. 0d. to £758 10s. 0d.; three months, £757 10s. 0d. to £758 10s. 0d.; settlement, £758 10s. 0d.

Lead (Refined Pig).—Second half September, £106 15s. 0d. to £107 0s. 0d.; second half December, £106 10s. 0d. to £107 0s. 0d.

Zinc.—Second half September, £92 0s. 0d. to £92 5s. 0d.; second half December, £91 15s. 0d. to £92 0s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £123 5s. 0d.; rolled zinc (boiler plates), all English destinations, £121 0s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £103 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 2s.10⅝d. per lb.; rods drawn, 3s. 7⅞d.; sheets to 10 w.g., 358s. 3d. per cwt.; wire, 3s. 5½d.; rolled metal, 344s. 0d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £232; B6 (85/15), —; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £288; HTB2 (38 tons), £300 HTB3; (48 tons), —.

Gunmetal.—RCH, 3/4 per cent. tin, —; BS1400, LG2 (85/5/5/5), £328; LG3 (86/7/5/2), £339; G1 (88/10/2/½), £405; (88/10/2/1), £394.

Phosphor Bronze.—BS1400, PB1 (AID released), £418 per ton.

Phosphor Bronze Strip, etc.—Strip, 502s. 9d. per cwt.; sheets to 10 w.g., 526s. 3d. per cwt.; wire, 5s. 1¾d. per lb.; rods, 4s. 5½d.; tubes, 4s. 3¾d.; chill cast bars: solids 4s. 5½d., cored 4s. 6¾d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 4s. 4¼d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 8¾d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 7¾d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 4d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £91 0s. 0d. to £94 0s. 0d. Nickel, £519 0s. 0d. Aluminium, ingots, £171 0s. 0d.; aluminium bronze (BS1400), AB1, £364; AB2, £376; Solder, brazing, BS1845, 3s. 0½d. lb.; granulated, 3s. 4½d. lb.

* Average 68-70 per cent.

Forthcoming Events

SEPTEMBER 26

Institute of British Foundrymen

Sheffield and district branch:—Presidential address by R. F. Horton, 7.15 p.m., followed by dinner in the premises of the Sheffield and Eccleshall Co-operative Society, Limited, Eccleshall Road, Sheffield, 11.

SEPTEMBER 27

Association of Bronze and Brass Founders

London Area:—Members meeting at the Clarendon Restaurant, Hammersmith, 11.30 p.m., followed, after luncheon, by an Advisory Service Meeting, open to all founders in the area, and "Costing for Bronze and Brass Foundries," by W. E. Harrison, 2.15 p.m.

Incorporated Plant Engineers

South Wales branch:—"Space Heating," by W. M. Barber, M.A.(Cantab), 7.15 p.m., at the South Wales Engineers' Institute, Park Place, Cardiff.

Institute of Industrial Supervisors

Mid-Somerset section:—"Need for Supervisory Training," by H. A. C. Tracey, 7.30 p.m., at J. Bibby & Sons, Bridgwater.

SEPTEMBER 28

Institute of British Foundrymen

Birmingham branch:—Presidential address by E. R. Dunning, followed by "Employer and Worker—Joint Responsibility for Accident Prevention," by R. Bramley-Harker, 7.30 p.m., at the James Watt Memorial Institute.

London branch:—Presidential address by F. Hudson, F.I.M., followed by "Film Night," 7.30 p.m., at the Waldorf Hotel, W.C.2.

East Anglian section:—Works visit to Crane, Limited, Nacton Road, Ipswich. (Details from the secretary.)

SEPTEMBER 29

Northampton Polytechnic

Department of Applied Chemistry:—Introductory Lecture on "Foundry Sands, their Properties, Testing and Applications," by Dr. J. E. Garside, 7 p.m., at St. John Street, London, E.C.1.

Incorporated Plant Engineers

Sheffield and district branch:—"Steelmaking and the Plant Engineer," by R. Mayorcas, 7.30 p.m., at the Grand Hotel.

SEPTEMBER 30

Institute of Industrial Supervisors

North-Western section:—"Delegation of Authority," by L. Helliwell, 7.30 p.m., at Houldsworth Hall, Manchester.

Increases in Capital

CRAVENS, LIMITED, Sheffield, increased by £50,000. in £1 ordinary shares, beyond the registered capital of £500,000.

THOS. STOREY (ENGINEERS), LIMITED, Stockport, increased by £700,000, in £1 shares, beyond the registered capital of £50,000.

WARREN ENGINEERING, LIMITED, London, E.C.2, increased by £500, in £1 ordinary shares, beyond the registered capital of £1,000.

CHAMBERLIN & HILL, LIMITED, ironfounders, of Walsall, increased by £45,000, in 5s. ordinary shares, beyond the registered capital of £55,000.

HARTLEY & SUGDEN, LIMITED, boilermakers, of Halifax, increased by £50,000, in £1 ordinary shares, beyond the registered capital of £90,000.

EDGAR ALLEN & COMPANY, LIMITED, Sheffield, increased by 1,000,000, in 600,000 ordinary and 400,000 unclassified shares of £1, beyond the registered capital of £1,500,000.

EVERED & COMPANY, LIMITED, brassfounders, of Smethwick (Staffs), increased by £450,000, in 100,000 ordinary and 350,000 unclassified shares of £1, beyond the registered capital of £550,000.

STEWART GILL & COMPANY, LIMITED, engineers, of London, W.C.2, increased by £11,500, in 6,500 6 per cent. cumulative redeemable preference and 5,000 ordinary shares of £1, beyond the registered capital of £1,000.

T. E. SALTER, LIMITED, engineers, stampers, iron and brass founders, etc., of Tipton (Staffs), increased by £25,000, in 10,000 6 per cent. cumulative preference and 15,000 ordinary shares of £1 each, beyond the registered capital of £5,000.

OXFORDSHIRE IRONSTONE COMPANY, LIMITED, London, W.1, increased by £200,000 in 100,000 "A" and 100,000 "B" shares of £1, beyond the registered capital of £100,000. Shareholders at March 8, 1954, included the Guest Keen Baldwin Iron & Steel Company, Limited, and Stewarts and Lloyds, Limited, with 49,900 and 49,500 shares, respectively.

LOW PHOSPHORUS
REFINED & CYLINDER
HEMATITE
MALLEABLE
DERBYSHIRE
NORTHAMPTONSHIRE
SWEDISH CHARCOAL

PIG-IRON

WILLIAM JACKS & CO. LTD.
LONDON, E.C.2.
Winchester House, Old Broad Street
London Wall 4774 (6 lines)

FERRO SILICON 12/14%
ALLOYS & BRIQUETTES
N.F. METALS & ALLOYS
LIMESTONE
GANISTER
MOULDING SAND
REFRACTORIES

And at:—

BIRMINGHAM, 2. 39, Corporation St., Midland 3375/6
LIVERPOOL, 2. 13, Rumford St., Central 1558
GLASGOW, C.2. 93, Hope Street, Central 9969

CLASSIFIED ADVERTISEMENTS

PREPAID RATES: Twenty words for 5s. (minimum charge) and 2d. per word thereafter. Box Numbers 2s. extra (including postage of replies).

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House, 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Tuesday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

FOUNDRY DIRECTOR, dissolution. Free in November, desires position as representative, or similar. Willing to move. Age 40. Own car available. Box FD483, FOUNDRY TRADE JOURNAL.

FOUNDRY WORKS MANAGER (42) M.I.B.F. seeks change, 16 years Managerial experience in Machine Tools, Textile and Light Castings for the Domestic Trades; Machine Shop and Light Assembly; Vitreous Enamelling of cast iron. Excellent Industrial record, Representation considered. Box FW499, FOUNDRY TRADE JOURNAL.

MECHANICAL ENGINEER, 30, A.M.I.Mech.E., A.M.I.B.F. Engineering College education, seeks responsible position with progressive company as SALES ENGINEER, material handling plant or foundry equipment. Midland area; car essential. Box ME514.

MANAGER desires post with progressive Foundry. Fully experienced practical man, technical and commercial. Production planning, layout design, organisation of jobbing repetition and mechanised foundries, producing automobile, diesel engine, electrical and general engineering castings. Accustomed to full control and handling all classes of labour.—Box MD519, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER seeks new top level appointment. 16 years' managerial experience in modern methods of production. Floor, machine and shell moulding in grey, high duty and special irons. Good background and qualifications.—Box FM524, FOUNDRY TRADE JOURNAL.

METALLURGIST (26), H.N.C., seeks progressive post as ASSISTANT FOUNDRY MANAGER. Sound knowledge of machine, loose pattern and shell moulding; iron and steel; experienced in cupola and converter operation, sand control, production and labour control, quality of castings and work study.—Box MS522, FOUNDRY TRADE JOURNAL.

SALES EXECUTIVE requires appointment with increased scope and prospects. Excellent contacts in the Casting field.—Box SE525, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 *inclusive or a woman aged* 18-59 *inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order,* 1952.

RADIOGRAPHER required as Assistant in Shipbuilding and Radiographic Department. Previous experience desirable but not essential as training can be given to applicant with suitable scientific background. Minimum educational requirement is the General Certificate of Education and the age range between 20 and 30. Replies should be addressed to LABOUR MANAGER, Vickers-Armstrongs (Engineers) Limited, Barrow-in-Furness, Lancashire.

SITUATIONS VACANT—*contd*

OLD - ESTABLISHED Birmingham Company requires ASSISTANT FOUNDRY FOREMAN. Maximum age 35. Must have served Non-ferrous Moulding apprenticeship. Permanent, pensionable and secure position for suitable applicant. Fares paid for interview. State age, trade qualifications, and practical experience. — Box O.E.502, FOUNDRY TRADE JOURNAL.

FOREMAN required for aluminium-alloy sand foundry in South-London area. Applicants should be fully experienced in all modern methods of sand rammer, shell, and jolt-squeeze moulding machines; coremaking; cost estimating; melting and metal-preparation techniques. Only first-class men need apply, giving full details of experience, age, etc., to Box FR470, FOUNDRY TRADE JOURNAL.

TECHNICAL SALES REPRESENTATIVE required by an expanding division of an East Midland Engineering Firm entering the Foundry Plant and Machinery field, to guide development as well as taking full responsibility for sales. Candidates should have wide sales experience, preferably including shell moulding and other modern techniques. The appointment will carry a salary appropriate to the qualifications and experience of the man chosen. The Company provide excellent conditions of employment, Pension Scheme, etc. Applications, which will be treated confidentially, should include details of age, qualifications and previous experience, including salaries earned, and should be addressed to PERSONNEL MANAGER, Box TS482, FOUNDRY TRADE JOURNAL.

BROWN, LENOX & CO., LTD., Pontypridd, require the services of an experienced METALLURGICAL LABORATORY ASSISTANT conversant with Steel Foundry Sand techniques. Applicants with training in a similar capacity will be considered. Apply WORKS METALLURGIST, Pontypridd.

SECTION LEADER/DRAUGHTSMAN required with practical knowledge of Servo electronics, pneumatic and other mechanical devices as applied to Gravity Die Castings and Coremaking machines. This is a Staff appointment and will classify for Pension Scheme. Apply in writing to the CHIEF DRAUGHTSMAN, Vowles Aluminium Foundry Company, Limited, Bank Street, West Bromwich.

REPRESENTATIVE required for London Area on a commission basis by a well-known Foundry producing small Grey and Malleable Castings. Good tonnage at present being produced for this area.—Box RR505, FOUNDRY TRADE JOURNAL.

NON - FERROUS FOUNDRY MANAGER (Directorship later) required, preferably experienced technically and commercially in centrifugal casting. Exceptional remuneration and an interest in financial results.—Apply in confidence, CHAIRMAN, Metals & Alloys, Ltd., Minworth, Birmingham.

SITUATIONS VACANT—*contd.*

METALLURGIST required to take complete charge of metal melting and analysis in iron foundry. Preference given to men with honours degree and must be experienced in the production of all high duty grades of cast iron. Commencing salary £800 per annum. ROBERT CORT & SON LTD., Reading.

ENGINEER, age 23—29, good education (H.N.C. Mech.Eng.), some foundry experience advantageous, required by large foundry and engineering company in North Midlands. State full particulars of education and experience to Box EA515, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN required for expanding Non-ferrous Foundry, semi-mechanised. Good opening for experienced man. Good conditions, pension scheme. Housing help.—Write full details Box FF520, FOUNDRY TRADE JOURNAL.

PATTERNMAKERS required. Permanency. Experienced in wood and metal by small master shop in South-West London.—Box PR521, FOUNDRY TRADE JOURNAL.

FOREMAN (aged 30/40) required for London Iron Foundry producing about 70/80 tons per month, machine and jobbing.—Write in first instance, giving particulars of age, experience, and salary required, to Box FA523, FOUNDRY TRADE JOURNAL.

REQUIRED for SINGAPORE: One METALLURGIST and one FOREMAN MOULDER, preferably single men, age 25-34, with sound basic training and subsequent practical experience in steel and iron founding. Attractive salary, three years agreement, six months home leave on full pay after four years' resident service, free quarters with heavy furniture and other benefits. Permanency and opportunity for advancement for qualified energetic and ambitious men. Write Box ZP.799, DEACON'S ADVERTISING, 36, Leadenhall Street, London, E.C.3.

GREY IRONFOUNDERS in West Midlands seek the services of young FOUNDRY FOREMAN, 25/35. Applicant must have served apprenticeship and have reasonable knowledge of Jobbing Foundry practices. Excellent opportunity for keen and energetic man.—Write, giving full particulars, Box GI493, FOUNDRY TRADE JOURNAL.

R. & A. MAIN, LTD., invite applications for the position of ASSISTANT GENERAL MANAGER at their Edmonton Works. Applicants should have an engineering background with a University Degree or Corporate Membership of one of the recognised Institutions. Age between 30 and 45. Administration ability is important. Excellent future prospects are offered with an attractive salary and contributory pension scheme. Please address applications in confidence to the GENERAL MANAGER, R. & A. Main, Ltd., Angel Road, Edmonton, London, N.18.